Workshop Manual

(Group 22-26)

TAD1240GE, TAD1241GE/VE
TAD1242GE/VE, TWD1240VE

Industrial Engines

TAD1240GE, TAD1241GE/VE TAD1242GE/VE, TWD1240VE

Contents

GROUP 20 GENERAL INFORMATION
Safety Information 2
General Information 5
General repair instructions 6

GROUP 22 LUBRICATING SYSTEM
General 8
Special tools 9
Design and Operation
Lubrication system 10
Repair instructions
Working with chemicals, fuel and lubricating oil 12
Oil filter, changing 12
Oil sump gasket, changing 13
Oil filter bypass valve, replacing 14
Safety valve, changing 15
Reducing valve, changing 15
Piston cooling valve, changing 16
Bypass filter (turbocharger) bypass valve, changing 17
Bypass valve (pressure valve) oil cooler, changing 17
Piston cooling nozzle, changing 18
Oil pump, changing 19
Oil pressure, checking 21
Engine oil, changing 22
Oil cooler element, changing 22
Oil cooler element, leakage test 26

GROUP 23 FUEL SYSTEM
General 28
Instructions for working with electronic fuel injection 28
Special tools 29
Design and Operation
Unit injectors, overview 31
Unit injectors, working phases 32
Repair instructions
Control module (EDC III), changing 34
Fuel system, draining 36
Fuel filter, changing 37
Fuel pump, changing 38
Fuel pump, rebuilding 39
Fuel system, bleeding 41
Bypass valve, changing 42
Fuel pressure, checking 43
Unit injectors, changing 44
Draining condensate water 48
Fuel pre-filter with water monitor, changing 48
Copper sleeve for unit injector, change 49

GROUP 25 INTAKE AND EXHAUST SYSTEMS
General 55
Design and Operation
Turbocharger 56
Repair instructions
Working with chemicals, fuel and lubricating oil 57
Intake manifold (gasket), changing 57
Exhaust manifold gasket, changing 63
Turbocharger, changing 66
Pressure drop indicator, checking 69

GROUP 26 COOLING SYSTEM
General 70
Special tools 71
Design and Operation
Cooling system (TAD) 72
Cooling system (TWD) 73
Charge air cooler 74
Repair instructions
Cooling system, draining 75
Cooling system, filling 75
Coolant pump, changing 76
Coolant filter, changing 79
Piston thermostat, changing 80
Piston thermostat, functional check 81
Drive belts, changing 82
Cooling system, cleaning 85
Charge air cooler, changing (TAD) 86
Charge air cooler, changing (TWD) 87
Charge air cooler, leakage test (TAD) 90
Charge air cooler, cleaning 91
Radiator core, changing 92
Cooling system, leakage testing 96
Extra coolant pump, changing (TWD) 98

Safety Information

Introduction

The Service Manual contains descriptions and service instructions for the Volvo Penta products and versions of products listed in the list of contents. This manual should be used in conjunction with the Service Manual ***Technical Data*** for the engine in question. Make sure that the right service literature is used.

Read the available safety information and the ***General information*** and ***Repair instructions*** sections in the Service Manual carefully before starting service work.

Important

The following special warning symbols occur in the Service Manual and on the products.

WARNING! Warns of the danger of injury, extensive damage to the product or to property, or that serious functional failure could happen if the instructions are not followed.

IMPORTANT! Used to draw attention to anything that could cause injury or malfunction of a product or damage to property.

NOTE: Used to draw attention to important information that will facilitate repairs or other operations.

To provide an overview of the dangers you should always be aware of and the precautionary measures that should always be taken, we have listed them here.

Make it impossible for the engine to start. Turn off the power at the main switch (or switches) and lock it (them) in the OFF position before starting service work. Place a warning sign in the operator's area.

As a rule, all service work should be carried out when the engine is not running. However, some tasks, such as certain adjustments, need the engine to be running. Approaching a running engine can be dangerous. Keep in mind that loose-fitting clothes or long hair may get caught in rotating parts and cause severe injury.

When working near a running engine, remember that a careless movement or a dropped tool could, in the worst case, lead to bodily harm. Be careful of hot surfaces (exhaust pipes, the turbocharger, turbocharger air ducts, starter etc.) and hot liquids in lines and hoses on a running engine or one that has just been stopped. Before starting the engine, replace all guards and protections that were removed during service work.

Make sure that the warning and information decals on the product are always in plain sight. Replace decals that are damaged or that have been painted over.

Never start the engine unless the air filter is in place. The rotating impeller in the turbocharger could cause serious injuries. Foreign objects in the intake could also damage the machinery.

Never use a starter spray or the like to help start the engine. It could cause an explosion in the intake manifold with the danger of injury.

Start the engine in well-ventilated spaces only. If the engine is run in a confined space, exhaust gases and crankcase gases should be vented away from the engine room or shop area.

Avoid opening the coolant filler cap while the engine is still hot. Steam or hot coolant could boil out when the cooling system's pressure is lost. If necessary open the filler cap slowly and release the pressure in the cooling system. Be extremely careful if a valve, plug or coolant line has to be removed while the engine is still hot. Steam or hot coolant could squirt out in an unexpected direction.

Hot oil can cause burns. Avoid getting hot oil on your skin. Make sure that pressure in the lubricating system is released before starting any work on it. Never start or run the engine with the oil filler cap removed because oil under pressure could then escape.

Stop the engine before doing any work on the cooling system.

If other equipment attached to the engine changes its center of gravity, special lifting devices may be needed to obtain the right balance and ensure safe handling.

Never work on an engine that is only suspended from a lifting device.

Never work alone when heavy components are to be removed, not even when a safe lifting device like a lockable block and tackle is used. Two people will generally be required, one to handle the lifting device and the other to make sure that the components are clear and are not damaged during the lift.

Always make sure in advance that there is enough room to work in with no danger of causing injury or material damage.

WARNING! The electrical system and fuel system on Volvo Penta products are designed and manufactured to minimize the risk of explosion and fire. The engine must not be run in an environment where it will be exposed to explosive liquids or vapors.

Always use the fuel recommended by Volvo Penta. See the Owner's Manual. The use of a poorer grade of fuel could damage the engine. On a diesel engine, a poor grade of fuel could lead to binding of the control rod and overrevving of the engine with a consequent risk of injury and damage. Poor fuel can also cause higher maintenance costs.

When cleaning with high-pressure equipment, remember: never direct the jet of water on seals, rubber hoses, electrical components or the radiator. Never use the high-pressure function when cleaning the engine.

Always use protective goggles when working where splinters, grinder sparks or splashes of acid or other chemicals could occur. Eyes are especially sensitive and an injury could result in loss of sight.

Avoid getting oil on your skin. Prolonged or recurring contact with oil can remove the skin's natural moisture with irritation, dehydration, eczema and other skin disorders as a result. Used oil is more harmful than fresh oil. Wear protective gloves and avoid clothes and rags contaminated with oil. Wash regularly, particularly before meals. Use skin lotion intended for this purpose to avoid dehydration and to help cleanse the skin.

Most chemicals intended for the products (such as engine and transmission oils, glycol, gasoline and diesel fuel) or chemicals for shop use (such as degreasers, paints and solvents) are dangerous to your health. Carefully read the instructions on the container. Always follow the prescribed safety rules (for the use of respirators, protective goggles, gloves, etc.). Make sure that other personnel are not accidentally exposed to substances that are dangerous to health—by breathing vapors, for example. Make provision for good ventilation. Dispose of used and surplus chemicals in the prescribed way.

Take great care when looking for leaks in the fuel system or testing fuel nozzles. Wear protective goggles. The jets from a fuel nozzle are under very high pressure and have great penetrating power; the fuel can penetrate deep into body tissues and cause serious injury, including the risk of blood poisoning.

WARNING! Under no circumstances should the engine's high-pressure tubing be bent or reshaped. Damaged tubing must be replaced.

All fuels and many chemicals are flammable. Make sure that they cannot be ignited by an open flame or spark. Gasoline, certain solvents and hydrogen from batteries, when mixed with air in the right proportions, are highly flammable and explosive. No smoking! Arrange for adequate ventilation and take the necessary safety precautions before starting welding or grinding in the vicinity. Always keep a fire extinguisher easily accessible at the workplace.

Make sure that rags contaminated with oil or fuel, as well as used fuel or oil filters, are kept in a safe place prior to their disposal. Under certain conditions, spontaneous combustion can occur in oily rags. Used fuel and oil filters, along with used lubricating oil, contaminated fuel, left-over paint, solvents, degreasers and detergents are all environmentally hazardous waste and should be taken to a recycling facility for proper treatment.

⚠ Batteries should never be exposed to open flames or electric sparks. Never smoke near batteries. When batteries are being charged they give off hydrogen gas, which combines with air to form a mixture that is highly flammable and extremely explosive. If batteries are connected incorrectly a spark can occur that could cause a battery to explode with injury and damage as a result. Do not disturb the connections when attempting to start an engine (risk of sparks) and do not lean over a battery.

⚠ Never mix up the positive and negative terminals when installing batteries. A wrong connection could cause serious damage to the electrical equipment. Check against the wiring diagram.

⚠ Always wear protective goggles when charging and handling batteries. The battery electrolyte contains highly corrosive sulfuric acid. If it gets on your skin, wash the area with soap and plenty of water. If the electrolyte gets in your eyes, rinse them at once with plenty of water and see a doctor as soon as possible.

⚠ Stop the engine and cut off the power at the main switch (or switches) before starting to work on the electrical system.

⚠ The clutch should be adjusted with the engine switched off.

⚠ Use the lifting eyes mounted on the engine when lifting it. Always check that all lifting equipment is in good condition and that it has the right capacity for the job (weight of engine plus gearbox and extra equipment, if any).

To ensure safe handling and to avoid damaging components mounted on the top of the engine, the engine should be lifted using a special-purpose fixture or an adjustable one set up for the engine. All chains or cables should run parallel to each other and be as perpendicular as possible to the top of the engine.

General Information

About the Service Manual

This Service Manual contains descriptions of and repair instructions for the standard versions of the TAD1240GE, TAD1241GE/VE, TA1242GE/VE and TWD1240VE model engines.

The Service Manual may show procedures performed on any of the engines listed above so the illustrations and photographs showing certain details may not be completely accurate in some cases. However, the repair methods are all essentially the same. The engine model and serial number are given on the data plate (see “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE and TWD1240VE”). The engine model and serial number should always be given in all correspondence concerning any of the engines.

The Service Manual is primarily produced for Volvo Penta service facilities and their qualified personnel. It is therefore assumed that persons using the manual have the necessary basic knowledge and can carry out the mechanical and electrical tasks that occur in their profession.

Volvo Penta is continuously developing its products and we therefore reserve the right to introduce changes and modifications. All the information in this manual is based on product data available at press time. Any significant changes that have been introduced in the product or service methods after that date will be announced in the form of Service Bulletins.

Spare parts

Spare parts for the electrical and fuel systems are subject to different national safety requirements. Volvo Penta Original Spare Parts meet these requirements. All types of damage occurring as a result of using non-original Volvo Penta spare parts for the product in question will not be covered under the terms of warranty as provided by Volvo Penta.

Certificated engines

For engines that are certificated for national and regional environmental legislation, the manufacturer undertakes to ensure that the environmental requirements are met both in new engines and in those already in use. The product must correspond to the sample product that was approved for certification. For Volvo Penta to be answerable as the manufacturer for ensuring that engines in use meet the stipulated environmental requirements, the following requirements regarding service and spare parts must be fulfilled:

The service intervals and maintenance measures recommended by Volvo Penta must be followed.

Only Volvo Penta Original Spare Parts intended for the certificated version of the engine may be used.

Service affecting injection pumps, pump settings or unit injectors must always be carried out by an authorized Volvo Penta facility.

The engine must not be rebuilt or modified in any way, except for the accessories and service kits that Volvo Penta has developed for the engine in question.

Modifications made to exhaust pipes and air intake ducts to install an engine in an engine room (ventilation ducts) must not be made indiscriminately as this could affect exhaust emissions. Security seals, if present, must not be broken by unauthorized personnel.

⚠ **IMPORTANT!** When spare parts are required, use only Volvo Penta Original Spare Parts.

If non-original spare parts are used, AB Volvo Penta will no longer be responsible for ensuring that the engine corresponds to the certificated version.

All types of injury, damages or costs arising from the use of non-original Volvo Penta spare parts for the product in question will not be covered by Volvo Penta.

General repair instructions

The working methods described in the Service Manual apply to a shop environment where the engine is lifted out of place and mounted on an engine stand. Unless otherwise stated, reconditioning work that does not require the engine to be removed can be carried out onsite using the same work methods.

The warning symbols that are used in the Service Manual (see ***Safety information*** for their meaning)

WARNING!

IMPORTANT!

NOTE:

are by no means comprehensive because we naturally cannot foresee everything that could happen when service work is being carried out under the most widely varying conditions. So we can only point out the risks that we consider could arise as a result of incorrect handling when working in a well-equipped shop using methods and tools that have been tested by us.

All work operations for which there are special Volvo Penta tools are described in the Service Manual using these tools. Special tools have been developed to ensure working methods that are as safe and efficient as possible. It is therefore the obligation of anyone using tools or working methods other than those recommended by us to make sure that no danger of injury or material damage exists and that malfunctions cannot result from such use.

In a number of cases there may be special safety rules and user instructions for the tools and chemicals mentioned in the Service Manual. Such rules and instructions must always be followed and no special instructions for this are given in the Service Manual.

The majority of risks can be avoided by taking certain elementary precautions and using common sense. A clean workplace and a clean engine eliminate many risks of injury and malfunction.

It is extremely important, especially in working on fuel systems, lubrication systems, intake systems, turbos, bearings and seals, to keep out dirt and other kinds of foreign particles. If this is not done, malfunctions or a shortened repair life could result.

Our common responsibility

Every engine consists of numerous interacting systems and components. The deviation of a component from its technical specification could dramatically increase the environmental impact of an otherwise good engine. It is therefore extremely important for specified wear tolerances to be maintained, for systems with provisions for adjustment to be correctly set and for Volvo Penta Original Spare Parts to be used. The service intervals in the engine maintenance schedule must be followed.

Certain systems, such as fuel system components, may require special competence and special testing equipment. For environmental and other reasons, certain components are sealed at the factory. Work on these components must not be done by persons who are not authorized for such work. Keep in mind that most chemical products, if incorrectly used, are hazardous to the environment. Volvo Penta recommends the use of biologically degradable degreasers for all cleaning of engine components unless otherwise expressly stated in the Service Manual. Take care to ensure that oils and residual detergent etc. are properly destroyed and do not inadvertently end up in the environment.

Tightening torques

Tightening torques for vital fasteners that should be tightened using a torque wrench are listed in “Technical Data: Tightening torques” and are also given in the Service Manual’s work descriptions. All tightening torques refer to clean threads, bolt heads and contact surfaces and lightly oiled or dry threads. If lubricants, thread locking compounds or sealants are required for certain fasteners, the type to be used is stated in the work description and in “Tightening torques.” The torques in the table below are applicable to fasteners for which no special torque is specified. These torques are for guidance only and the fastener in this case need not be tightened with a torque wrench.

Size	**Tightening torque**	
	Nm	**lbf.ft.**
M5	6	4.4
M6	10	7.4
M8	25	18.4
M10	50	36.9
M12	80	59.0
M14	140	103.3

Torque-angle tightening

In torque-angle tightening the fastener is tightened to a specified torque and then further tightened through a specified angle. Example: for 90° angle tightening the fastener is tightened an additional ¼ turn after the specified torque has been reached, all in the same operation.

Lock nuts

Lock nuts that have been removed must not be reused. New ones must be used because the locking characteristics of the old nuts deteriorate if they are used again. For lock nuts with a plastic insert, Nylock®, for example, the tightening torques in the table should be reduced if the Nylock® nut has the same depth as a standard all-metal hex nut. Reduce the tightening torque by 25% for 8 mm or larger thread sizes. For deeper Nylock® nuts, where the all-metal thread is as deep as that of a standard hex nut, the tightening torques in the table are applicable.

Strength classes

Nuts and bolts are divided into different strength classes; the strength class is marked on the bolt head. A higher number indicates a stronger material. For example, a bolt marked 10-9 is stronger than one marked 8-8. When reassembling components it is therefore important to make sure that bolts are reinstalled in their original places. When installing new fasteners, check the spare parts catalog to make sure that the correct type is used.

Sealants

Several different types of sealants and locking fluids are used on the engines. Their properties differ and they are intended for fasteners of different strengths, temperature ranges, resistance to oil and other chemicals, and for the various materials and clearances in the engine.

For service work to be fully satisfactory it is therefore important that the right sealants and locking fluids are used on the fasteners where they are needed.

In the appropriate sections of the Service Manual we have indicated the agents used in the assembly of our engines.

The same agents or agents with equivalent properties but from a different manufacturer should be used in service work.

When using sealing agents and locking fluids it is important for the mating surfaces to be free of oil, grease, paint and rust inhibitor. They must also be dry. Always follow the manufacturer's directions regarding temperature, hardening time and other instructions for the product.

Two different basic types of agent are used on the engines:

RTV agents (Room Temperature Vulcanizing). Used mostly as a sealant coating ("dope") on gaskets. RTV agents are easily visible when the gasket is removed and the old RTV agent must be cleaned off before the new gasket is installed.

The following agents are of RTV type: Loctite® 574, Volvo Penta 8408791, Permatex® No. 3, Volvo Penta 11610995, Permatex® No. 77. Old sealant can be removed in all cases with denatured alcohol.

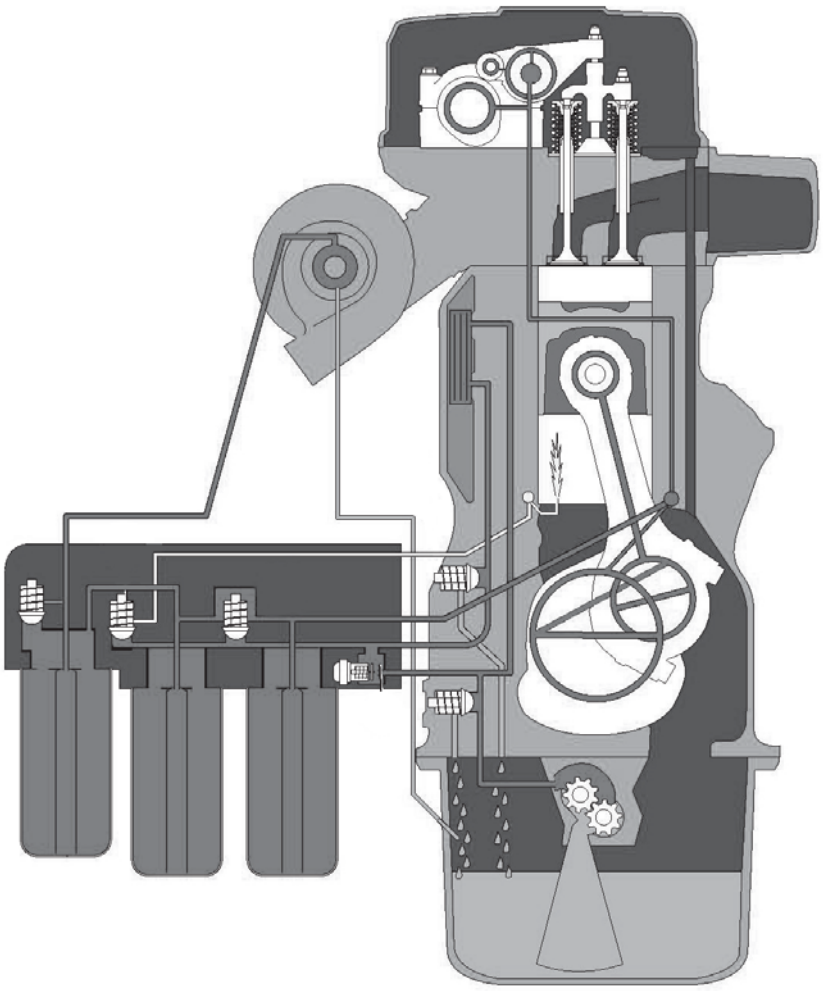
Anaerobic agents These harden in the absence of air. They are used when two solid parts like castings are fitted together without a gasket. They are also commonly used to secure and seal plugs, the threads of studs, valves, oil pressure monitors etc.

Hardened anaerobic agents are glassy; they are usually colored to make them more visible. Hardened anaerobic agents are highly resistant to solvents and old agent cannot be removed. When reinstalling a component, thorough degreasing is required followed by application of fresh sealant,

The following agents are anaerobic: Loctite® 572 (white), Loctite® 241 (blue).

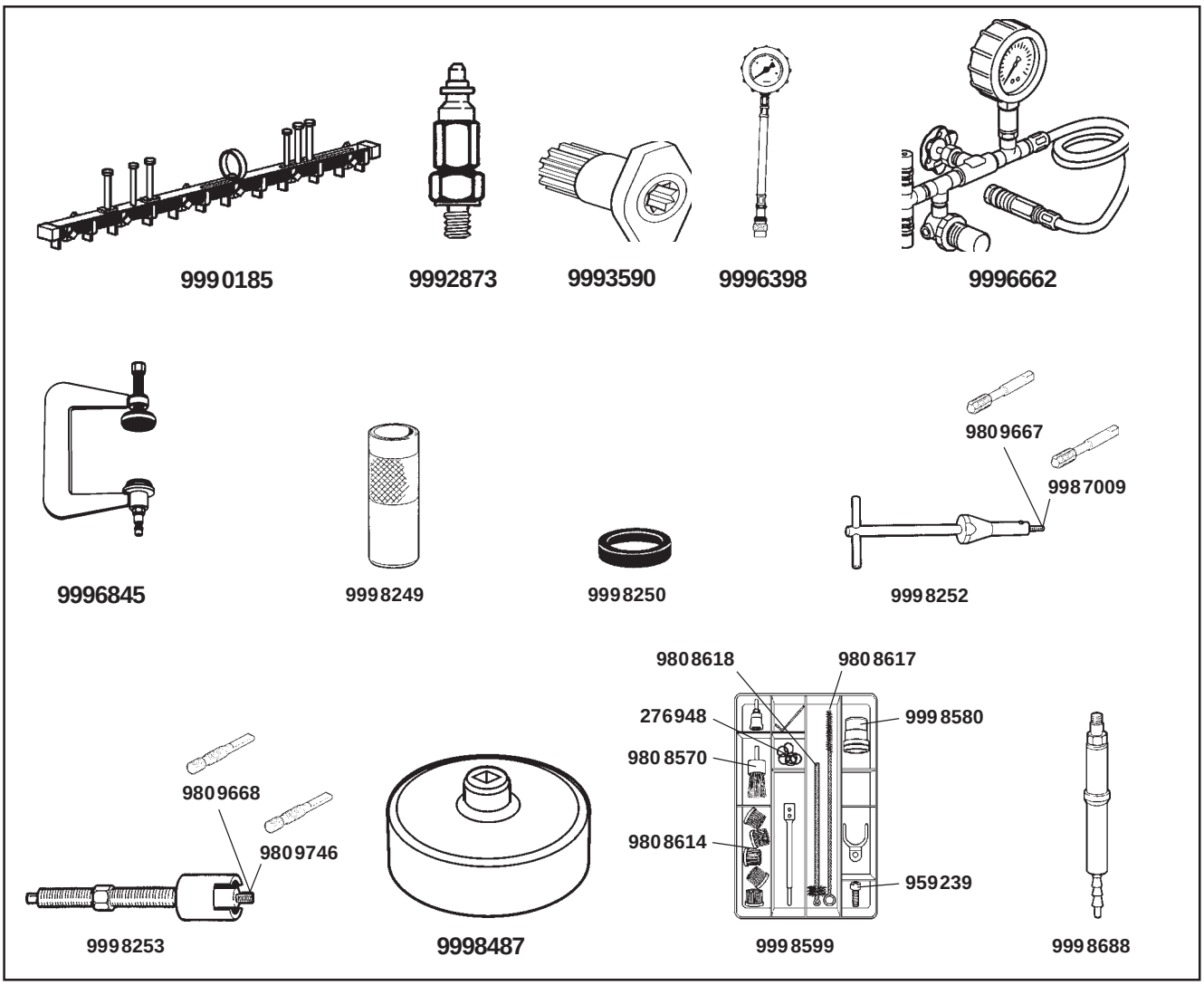
Note: Loctite® is a registered trademark of the Loctite Corporation, Permatex® is a registered trademark of the Permatex Corporation.

Group 22 Lubricating System



Tools

Special tools



9990185 Lifting tool for rocker bridge

9992873 Connector nipple

9993590 Twist tool

9996398 Pressure gauge

9996662 Leakage tester

9996845 Clamp

9998249 Protective sleeve [2] for unit injector (6 pcs. needed)

9998250 Seal ring [2] for fuel duct in cylinder head (2 pcs. needed)

9998252 Thread tap. Consists of:

- **9809667** Threading tool (M9) for removing the copper sleeve for the unit injector
- **9987009** Threading tool (M8) for removing the copper sleeve for the unit injector

9998253 Puller for copper sleeve for unit injector. Consists of:

- **9809668** Puller for copper sleeve for unit injector (M9)
- **9809746** Puller for copper sleeve for unit injector (M8)

9998487 Filter wrench

9998599 Cleaning kit for unit injector. Consists of:

- **276948** O-ring kit
- **959239** Screw M10
- **9808570** Brush, white
- **9998580** Socket
  Holder
- **9808634** **Brush kit.** Consists of:
  - **9808614** Brush, yellow (10 pcs)
    Holder (2 pcs)
    Handle
  - **9808617** Steel brush, narrow
  - **9808618** Steel brush, coarse

9998688 Expansion tool (Ø 7.8 mm / 0.307") for copper sleeve for unit injector

[2] Supplied individually.

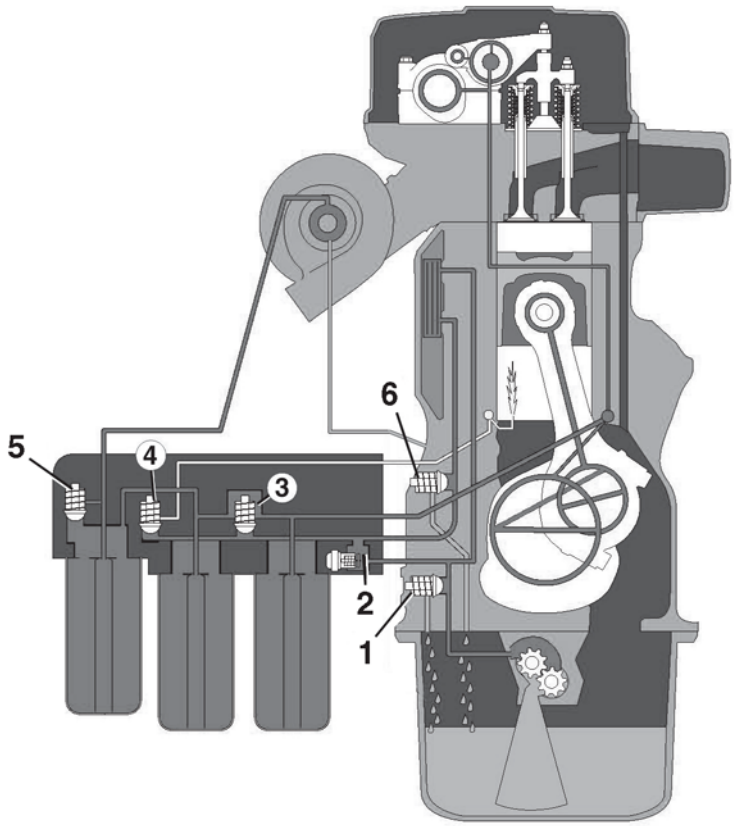
Design and Operation

Lubrication system

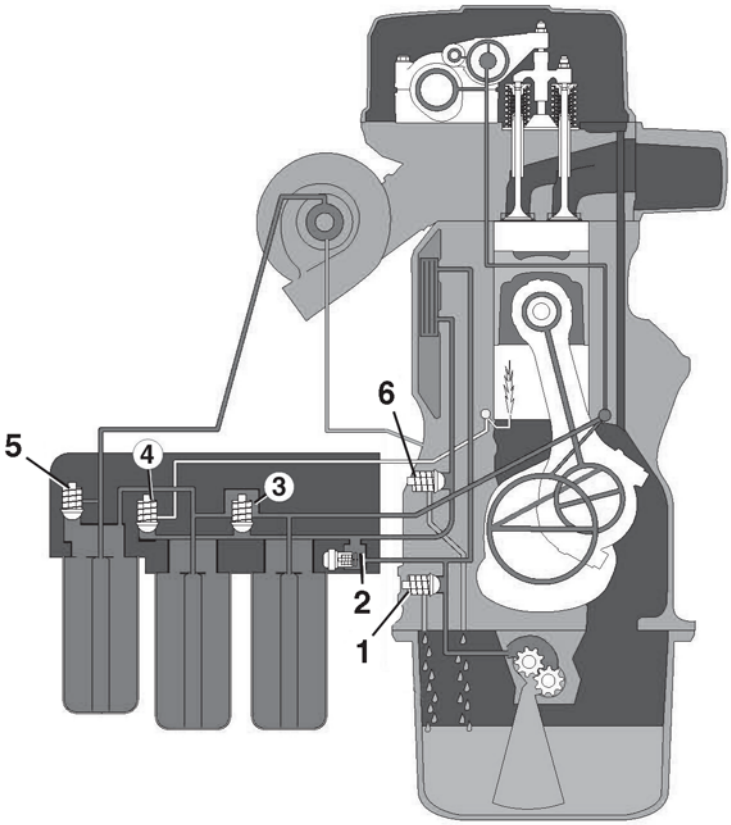
The engine is pressure-lubricated via a gear pump coupled to the engine transmission. The oil flow is regulated by six valves.

The oil pump pumps the oil to two full-flow filters and one by-pass filter, where the oil to the turbocharger is also filtered by about 5%. From the full-flow filter the oil is passed to the engine block and distributed through passages to the engine lubrication points.

The oil cooler is of the plate type and is located under a cast-iron cover on the right-hand side of the engine block.



1 Safety valve
2 Bypass valve for oil cooler
3 Bypass valve for oil filter
4 Piston cooling valve
5 Bypass valve for bypass filter (turbocharger)
6 Reducing valve



1 Safety valve

When the oil pressure across the safety valve exceeds 8.6 bar (125 psi), the valve opens and returns the oil to the oil pan.

2 Bypass valve for oil cooler

When the pressure across the oil cooler is low, for example, when the oil temperature is low immediately after start-up, the bypass valve opens and the oil bypasses the cooler. When the oil temperature rises and the pressure drop across the oil cooler falls (<3.0 bar, 45 psi), the valve closes and the oil flows through the oil cooler before being pumped into the lubrication system.

3, 5 Bypass valve for oil filter/bypass (turbocharger)

The bypass valve opens (>2.1 bar, 30 psi) to maintain lubrication when the filter is clogged.

4 Piston cooling valve

The piston cooling valve opens (3.0 bar, 45 psi) when the engine speed reaches just above idle. The oil flows through the piston cooling passages to the six piston cooling nozzles, where oil is sprayed onto the underside of the pistons.

6 Reducing valve

The reducing valve controls the oil pressure by opening at high pressure (5.7 bar, 80 psi) and returns the excess oil to the oil pan.

Repair instructions

Working with chemicals, fuel and lubricating oil

Important! Apply barrier cream to hands and always wear protective gloves for work where there is a risk of contact with oil, fuel or the like. Continual skin contact with engine oil dries out the skin and can be harmful.

Oil filter, changing

Special Tool: 9998487

1

Clean the oil filter canister.

2

Remove all oil filters with filter wrench 9998487.

3

Clean the sealing surface, check that no gasket residue remains.

4

Spread a thin layer of engine oil onto the gasket of the new oil filter and install filter.

5

Install the new oil filters, see oil filter installation instructions.

6

Top up engine oil and run the engine with the starter until the lubricating oil pressure appears on the pressure gauge. See “Instructions for running the starter motor”.

7

Start the engine and check for leaks around the oil filters.

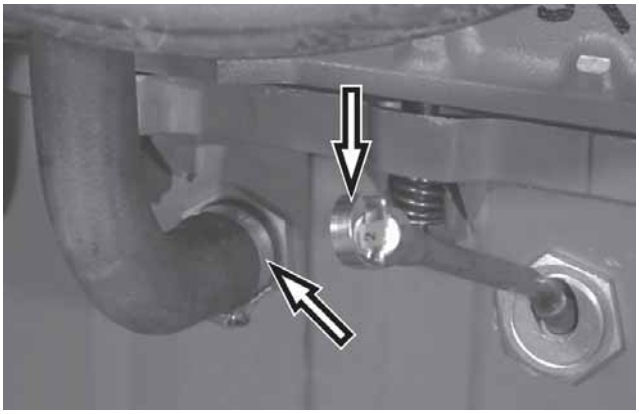
Oil sump gasket, changing

1

Pump out the engine oil.

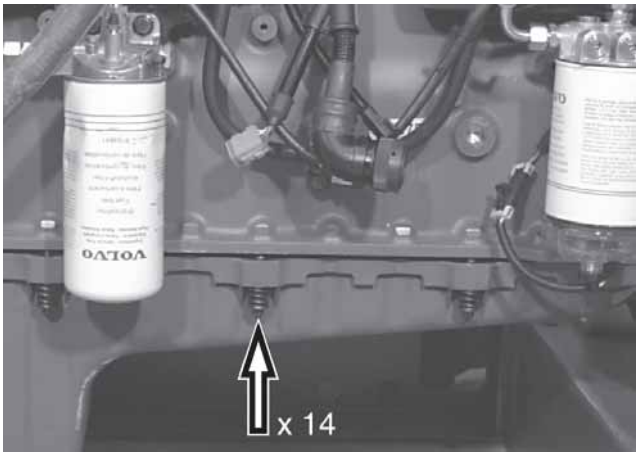
See “Engine oil, changing”.

2



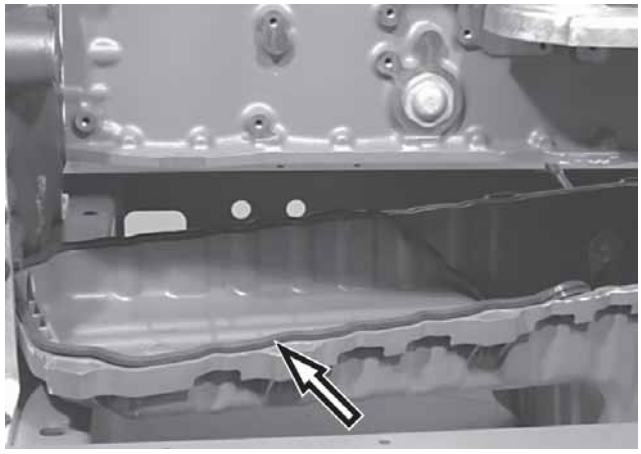
Remove the oil filler pipe and pull out the dipstick from the oil pan.

3



Remove the oil pan.

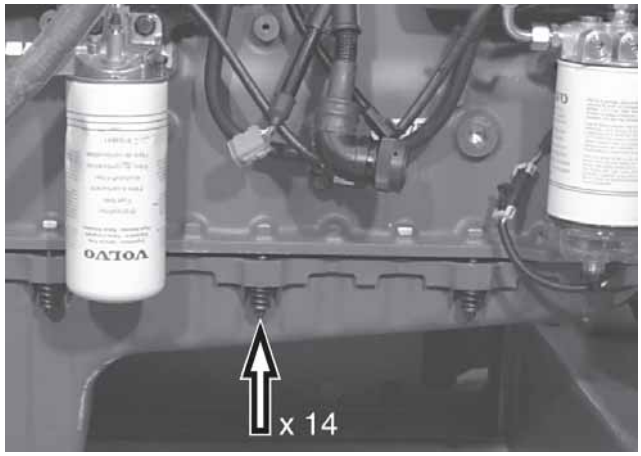
4



Remove the old gasket. Carefully clean the sealing groove on the lip of the oil pan and the contact surface on the engine block.

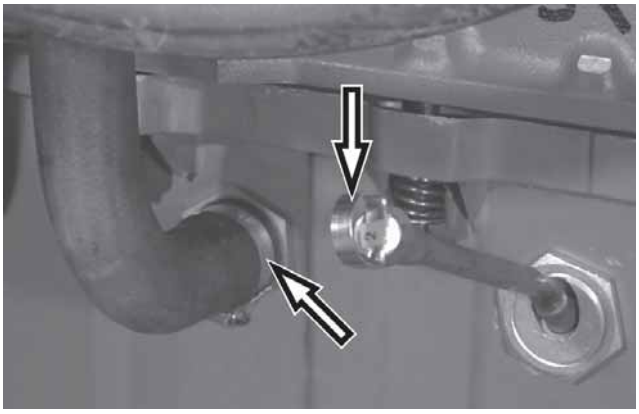
Install the new gasket in the groove on the lip of the oil pan.

5



Reinstall the oil pan.

6



Install the oil filler tube and replace the dipstick.

7

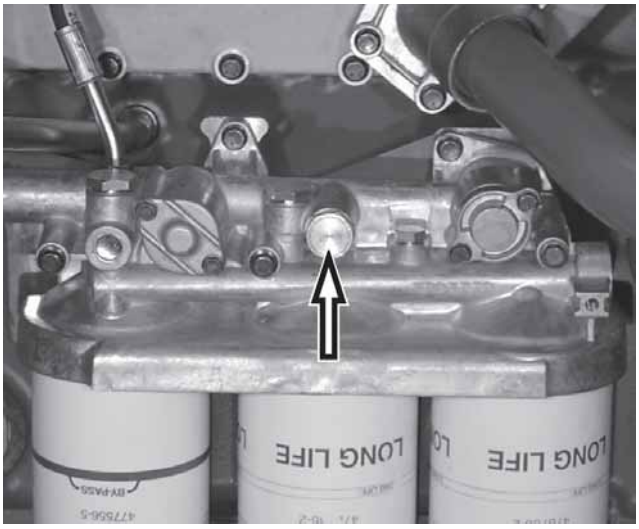
Add engine oil according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

8

Start the engine and check for leaks.

Oil filter bypass valve, replacing

1



Clean the oil filter bracket and remove the cover from the bypass valve.

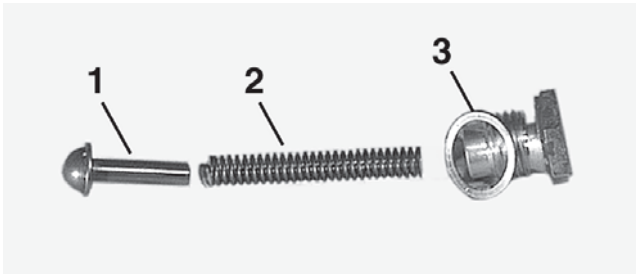
2

Remove the valve stem and spring.

3

Clean and check the valve seat. If the valve seat is damaged, the entire bracket must be replaced.

4



Install the new valve stem (1) and spring (2).

Use a new sealing washer (3), install and tighten the bypass valve cover.

5

Start the engine and check for leaks.

Safety valve, changing

Special tool: 9998487

1

Remove the right-hand oil filter with the filter wrench 9998487.

2

Clean around the cover on the engine block. Remove the cover and take out the safety valve.

NOTE: The safety valve cover takes a 50 mm wrench.

3

Clean and check that the old O-ring is not still in place.

4

Check that the new safety valve is marked with a yellow mark.

5

Install the new safety valve with new O-rings onto the engine block.

6

Install a new oil filter, see oil filter installation instructions.

7

Start the engine and check for leaks.

Reducing valve, changing

1

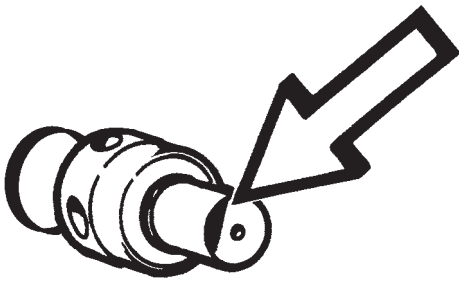
Clean around the cover on the engine block. Remove the cover and take out the reducing valve.

NOTE: The safety valve cover takes a 50 mm wrench.

2

Clean and check that the old O-ring is not still in place.

3



Check that the new reducing valve is marked with a blue mark.

4

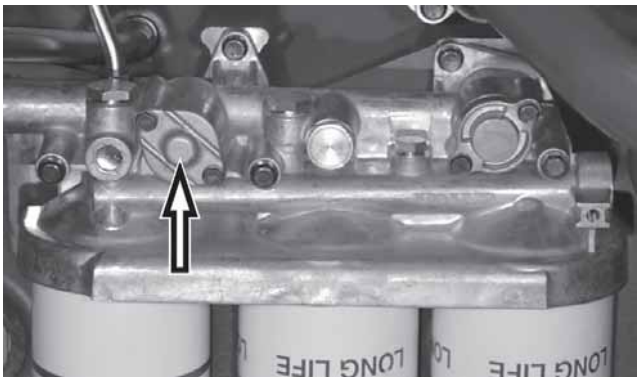
Install the new reducing valve with new O-rings onto the engine block.

5

Start the engine and check for leaks.

Piston cooling valve, changing

1

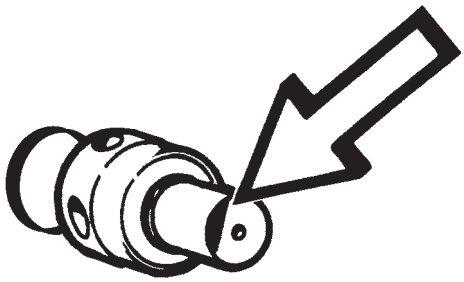


Clean the oil filter bracket and remove the cover from the piston cooling valve, take out the O-ring.

2

Take out the piston cooling valve, clean it and check that the old O-ring is not still in the oil filter bracket.

3



Check that the new piston cooling valve is marked with an orange mark.

4

Install the new valve with new O-rings in the oil filter bracket.

5

Screw on the piston cooling valve cover.

6

Start the engine and check for leaks.

Bypass filter (turbocharger) bypass valve, changing

1

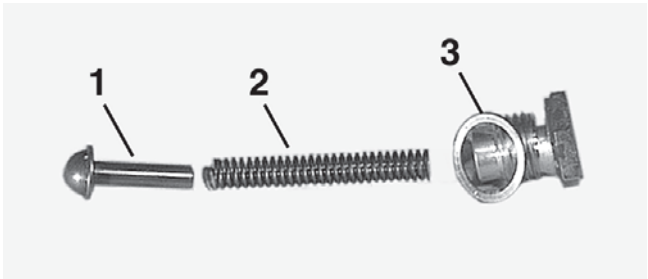
Clean the oil filter bracket and remove the cover from the bypass valve.

2

Remove the valve stem and spring.

3

Clean and check the valve seat. If the valve seat is damaged the entire bracket must be replaced.



4

Install the new valve seat (1) and spring (2).

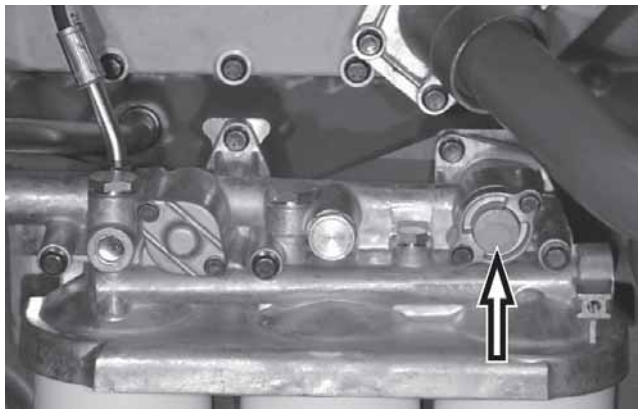
Reinstall the bypass valve cover. Use a new washer (3).

5

Start the engine and check for leaks.

Bypass valve (pressure valve) oil cooler, changing

1



Clean the oil filter bracket and remove the bypass valve cover; take out the O-ring.

2

Take out the bypass valve, clean it and check that the old O-ring is not still in the oil filter bracket.

3

Check that the new bypass valve is marked “124.”

4

Install the new bypass valve with new O-rings in the oil filter bracket and screw on the cover.

5

Start the engine and check for leaks.

Piston cooling nozzle, changing

Special tool: 9993590

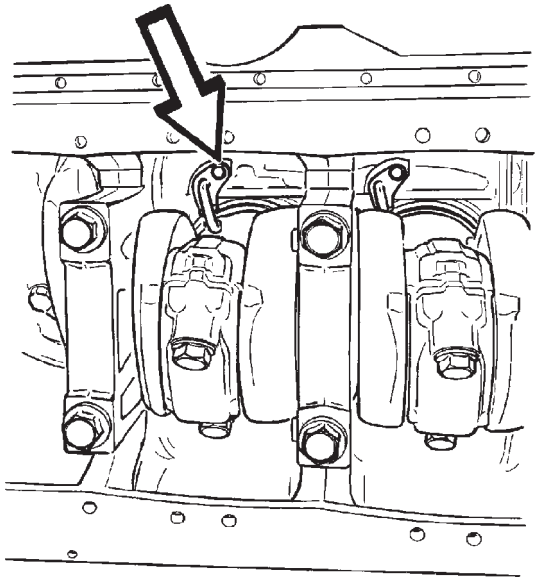
1

Remove the oil pan. See “Oil pan gasket, replacing.”

2

Install the twist tool 9993590.

3



Turn the crankshaft so that the piston cooling nozzle that is to be replaced is accessible.

4

Remove the piston cooling nozzle.

5

Install the new piston cooling nozzle with a new screw.

NOTE: The setscrew for the piston cooling nozzle is provided with a friction coating and can be used only once.

WARNING: Faulty piston cooling means piston damage.
If there is any suspicion that a piston cooling nozzle may be damaged or deformed, it must be replaced even if it is a new nozzle. Always check that the piston cooling nozzle is seated properly in the engine block and that the securing plate lies flat against the engine block.

If the piston cooling nozzle is not properly installed, the engine can be wrecked immediately upon starting.

6

Remove the twist tool and replace the cover.

7

Make a thorough check of the installation before the oil pan is replaced.

8

Replace the oil pan with a new gasket. See “Oil pan gasket, replacement.”

9

Start the engine and check for leaks.

Oil pump, changing

1

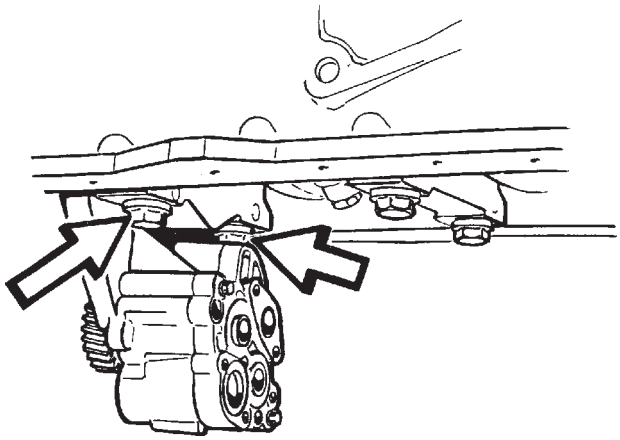
Pump out the engine oil.

See “Engine oil, changing”.

2

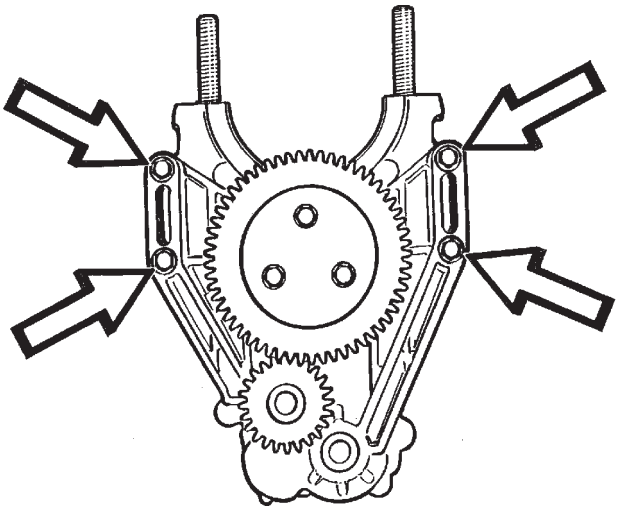
Remove the oil pan. See “Oil sump gasket, changing”.

3



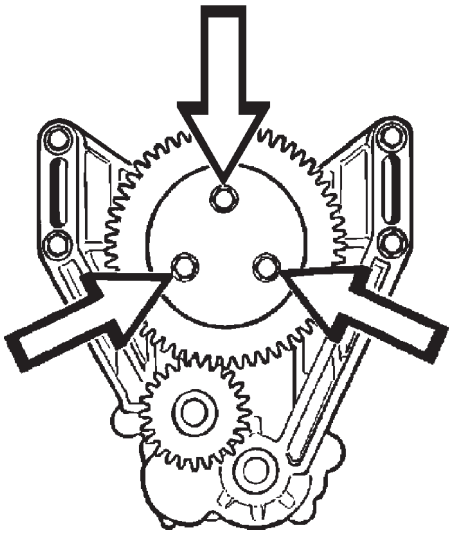
Remove the bolts for the front main bearing cap and lift down the lubricating oil pump together with the main bearing cap.

4



Remove the lubricating oil pump from the main bearing cap.

5



Remove the idler gear from the oil pump housing.

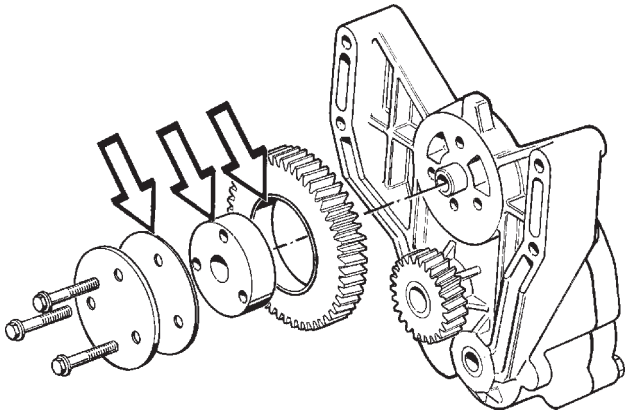
6

Clean the oil strainer. Check that the strainer is not damaged.

7

Clean and inspect the bearing and teeth on the idler gear.

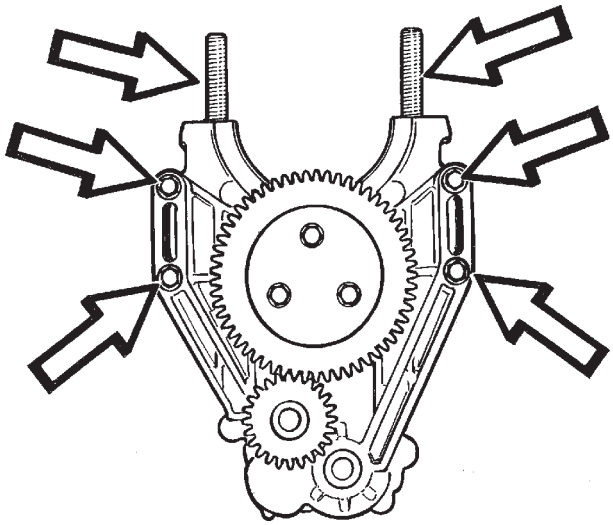
8



Oil the bearing with engine oil and install the idler gear on the new oil pump.

Torque the bolts to 24 ± 4 Nm (18 ± 3 ft-lbf).

9



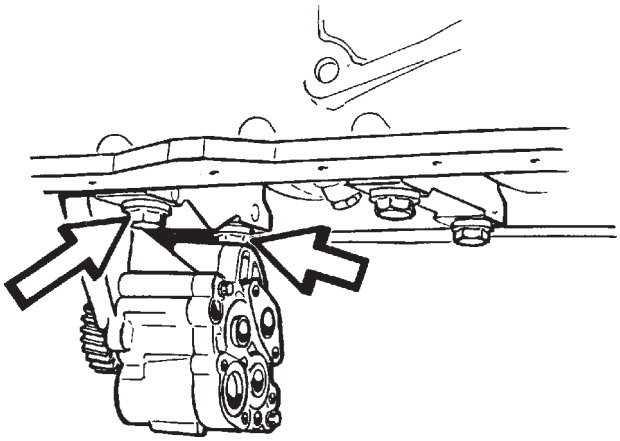
Install the new lubricating oil pump on the main bearing cap and tighten the bolts to 25 Nm (20 ft-lbf) and then tighten a further 90°.

NOTE: Remember to install the main bearing cap bolts before the lubricating oil pump is tightened onto the cap.

10

Clean the main bearing shell and oil it with engine oil.

11



Install the lubricating oil pump and check that the teeth on the idler gear mesh with the crankshaft gear teeth.

Tighten the main bearing cap:
Step 1. 150 ± 20 Nm (110 ± 15 ft-lbf).
Step 2. Tighten through a further 120° ± 5°.

12

Check the oil pressure tube for cracks in the flange at the bolt points.

13

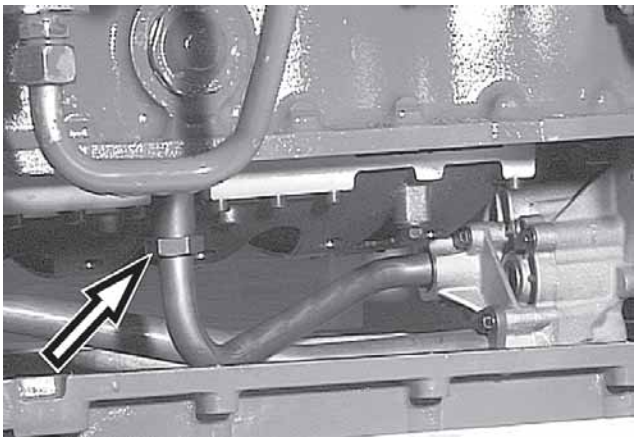
Install new O-rings for the oil strainer and oil pressure tube.

NOTE: Check that there are no cracks on the oil strainer.

14

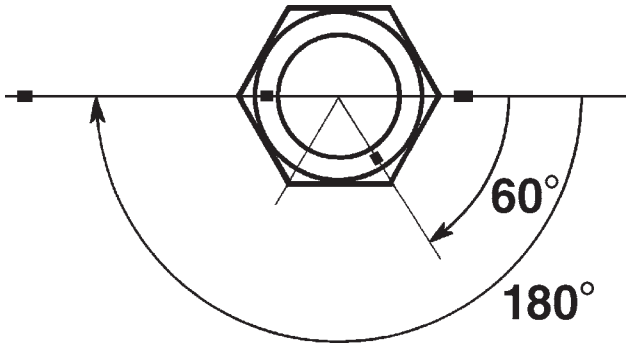
Attach the oil strainer to the lubricating oil pump and install the associated clamp. Tighten the bolts on the lubricating oil pump to 27 ± 4 Nm (20 ± 3 ft-lbf).

15



Install the oil pressure tube.

16



Snug up the oil pressure tube bolts, then tighten through an additional 180° for a new tube or 60° for a used tube.

17

Install the oil pan with a new gasket. See “Oil sump gasket, changing”.

18

Add engine oil according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

19

Run the engine with the starter according to instructions until oil pressure appears on the pressure gauge. See “Instructions for running on starter”.

20

Start the engine and check for leaks.

Oil pressure, checking

Special Tools: 9992873, 9996398

1

The lubricating oil pressure is checked by attaching pressure gauge 9996398 and nipple 9992873 to the rear plug (M16 x 1.5) on the left-hand side of the engine.

2

Carefully clean and remove the plug. Install nipple 9992873 and connect pressure gauge 9996398.

Ensure that the engine has reached operating temperature and measure the oil pressure at idle and at operating speed.

3

Compare the oil pressure measured with that given in the table below:

Oil pressure:	
Operating speed, 1100 RPM or higher	400-550 kPa (60-80 psi)
Idle, minimum	175 kPa (25 psi)

Engine oil, changing

Note: The oil should be changed with the engine warm.

1

Connect the drain hose to the oil pump and make sure there are no leaks.

⚠ **WARNING!** Hot oil can cause burns.

2

Pump out the oil.

NOTE: Collect all old oil and hold it for recycling.

3

Remove the drain hose.

4

Add engine oil according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

Oil cooler element, changing

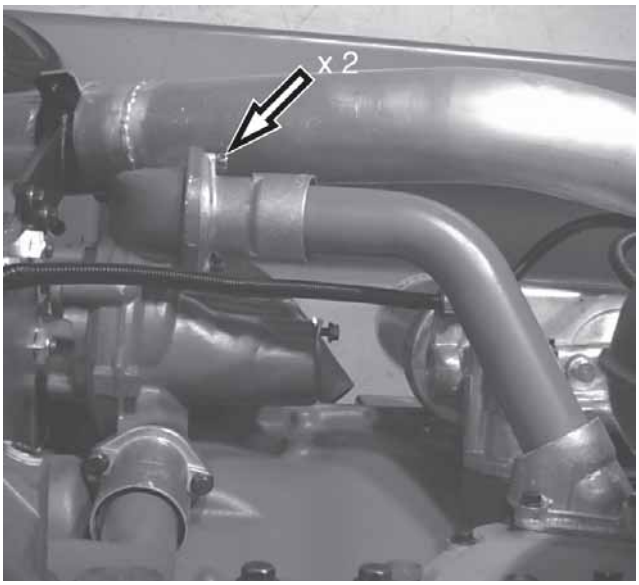
1

Drain the cooling system, see “Cooling system, Draining”.

2

Open the main switch(es) and check that power to the engine is off.

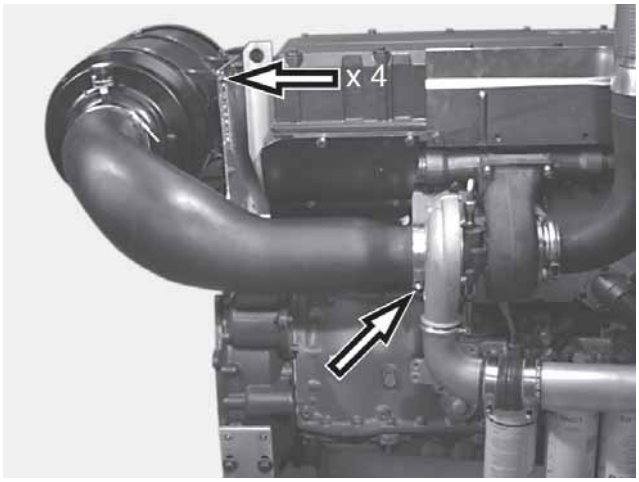
3



Remove the pipe between the coolant pump and the cover of the oil cooler element.

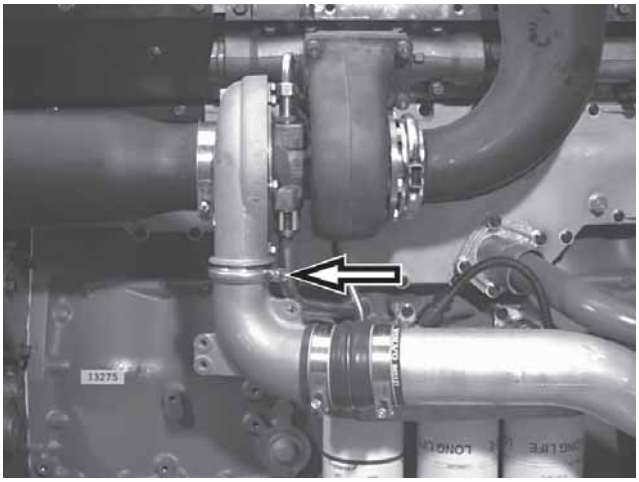
NOTE: Cover the hole to the coolant pump.

4



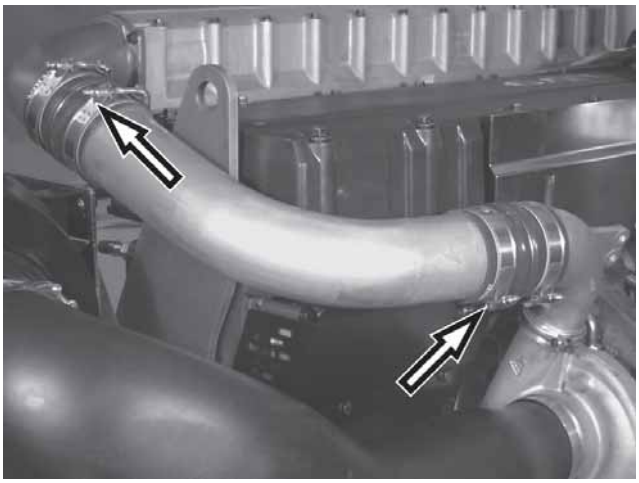
Release the clamp on the turbocharger and remove the air filter from the bracket. Remove the air filter and air hose.

5 (TAD Engine)



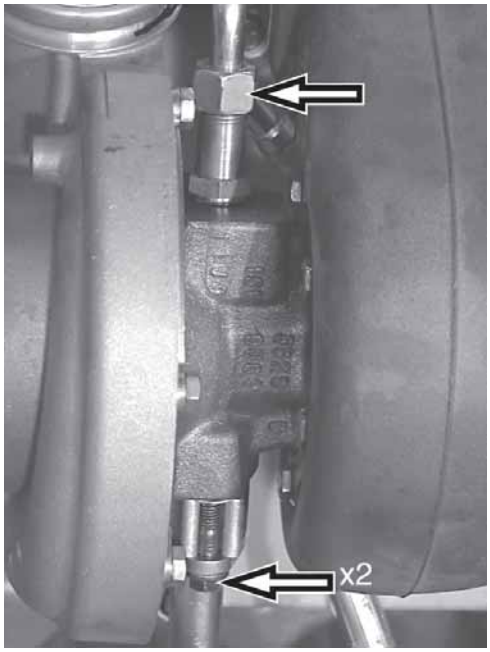
Remove the turbo intake duct at the turbo.

5 (TWD Engine)



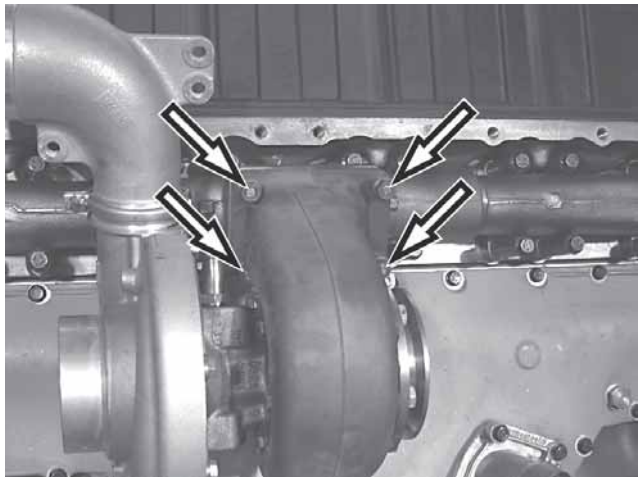
Remove the turbo intake duct.

6



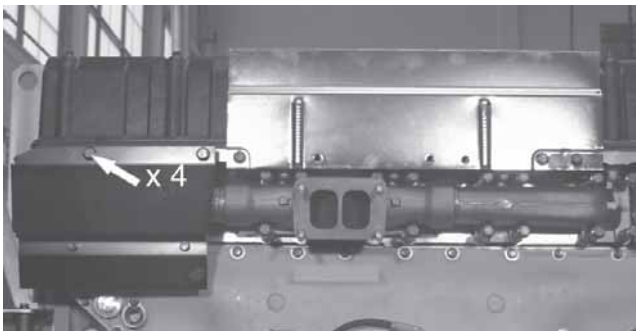
Remove the oil pipe from the turbocharger.

7



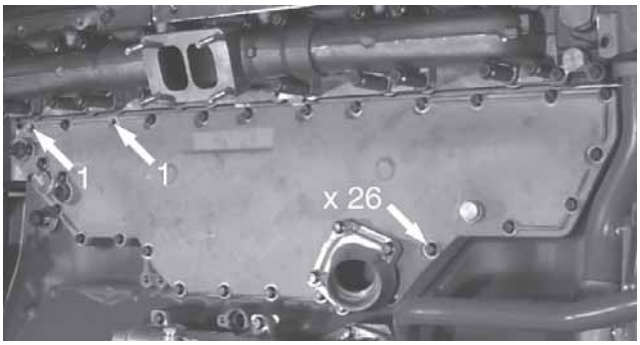
Remove the turbocharger.

8



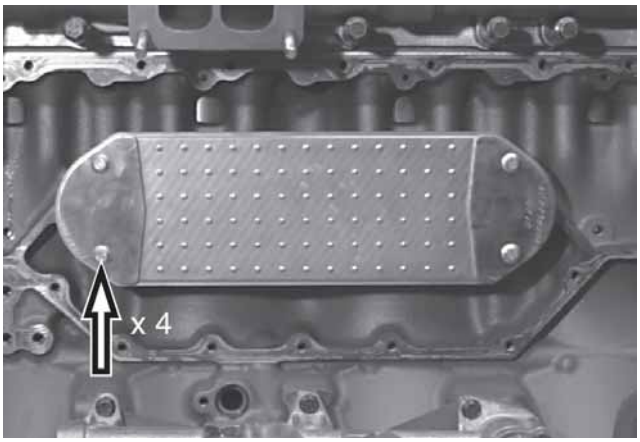
Remove the rear cover plate (four bolts). Two of these are installed on the cover of the oil cooler element.

9



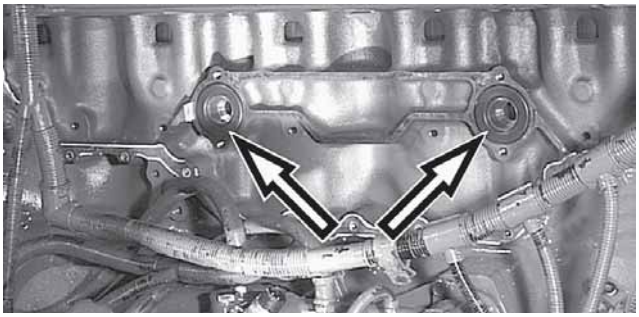
Loosen the remaining bolts and remove the cover of the oil cooler element.

10



Remove the oil cooler element.

11

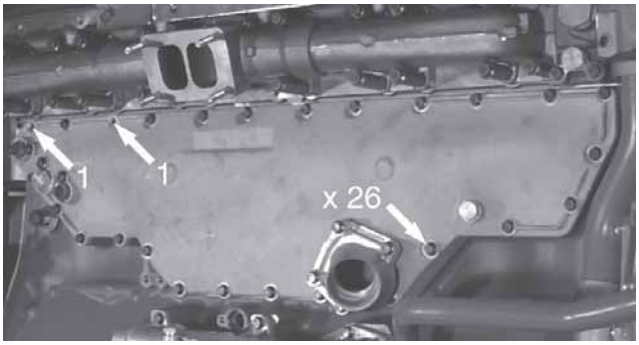


Remove the sealing rings on the engine block and remove the seals in the cover. Clean all contact surfaces.

12

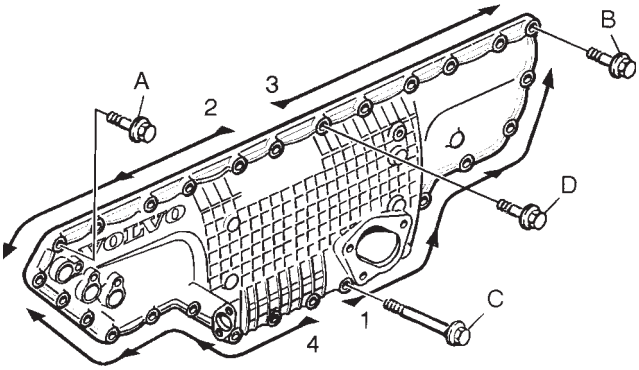
Clean and install new sealing rings in the engine block. Tighten the oil cooler element to 27±4 Nm (20±2 ft-lbf).

13



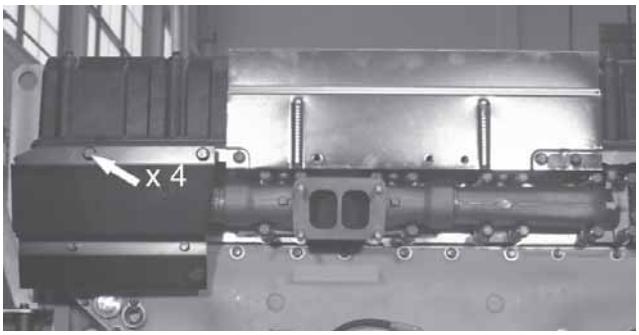
NOTE: The rear cover plate is mounted together with the cover of the oil cooler element (1).

Install a new seal in the cover, lift it into place and tighten the bolts to 24±4 Nm (18±3 ft-lbf) as specified in the torque table. Always use new drift pins when installing the cover on the engine.



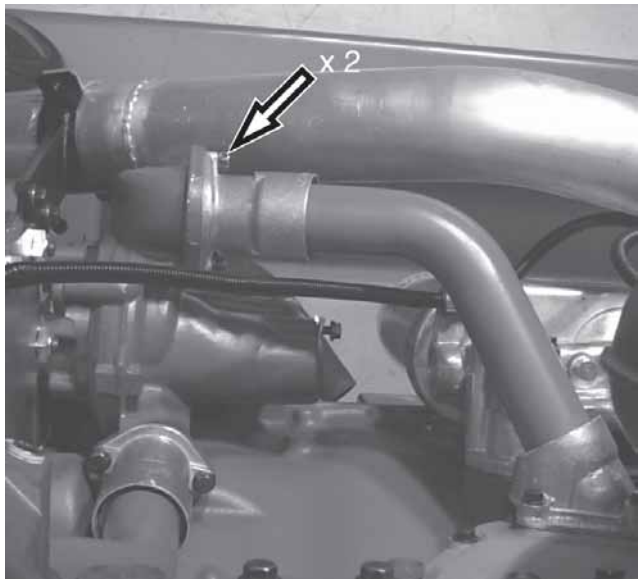
1 Install bolts A and B for alignment.
2 Tighten bolts C and D.
3 Install all bolts, tighten them in numerical order from the center outwards as shown in the figure (1-4).
4 Check the torque on bolts C and D.

14



Install the rear cover plate (four bolts). Two of these are mounted together with the cover for the oil cooler element.

15



Install the water pipe between the cover of the oil cooler element and the coolant pump. Use new seals.

16

Install the turbocharger, see “Turbocharger, changing”.

17

Add engine oil to specification. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE and TWD1240VE”.

18

Add coolant to specification. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE and TWD1240VE”.

NOTE: Mix the correct volume in advance to ensure that the system is filled.

19

Start the engine and check for leaks.

Oil cooler element, leakage test

Special tools: 9996662, 9996845

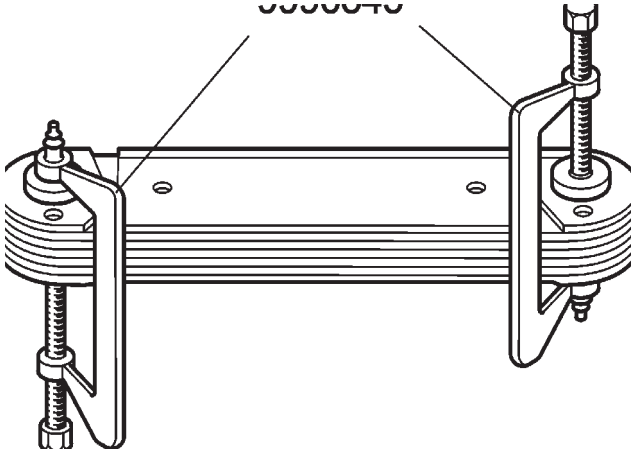
1

Remove the oil cooler element, see “Oil cooler element, changing.”

2

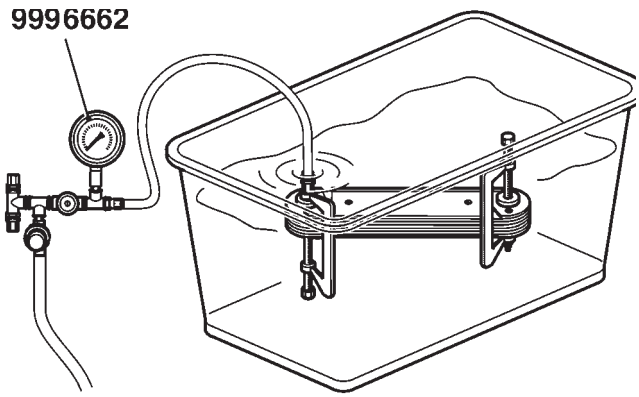
Rinse off the coolant side and the oil side of the oil cooler with degreaser.

3



Tighten clamp 9996845 to test the oil cooler element for leaks and check that it seals properly.

4



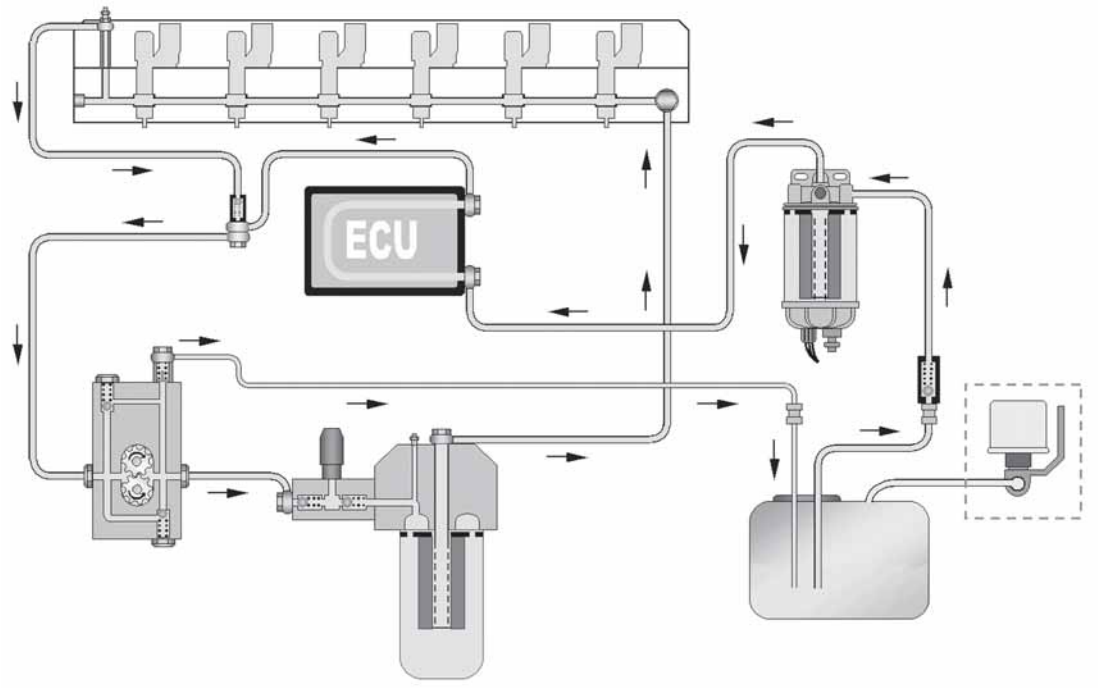
Check that the knob on the reduction valve on the pressure gauge is turned all the way counter-clockwise and that the gauge is at 0. Connect the pressure gauge to clamp 9996845 to test the oil cooler element for leaks. Immerse the oil cooler element in a room-temperature water bath.

Turn the knob to increase the pressure to 250 kPa (35 psi).

Wait at least one minute.

If a steady stream of bubbles comes out of the oil cooler element it leaks and must be replaced.

Group 23 Fuel System



General

⚠ **IMPORTANT!** Ensure maximum cleanliness when working with the fuel system. Always clean the engine before starting repair work. To prevent contamination of the fuel system, always install protective plugs when connections are removed. Parts removed should be kept in a closed plastic bag until they are reinstalled.

⚠ **IMPORTANT!** If the engine is turned over using the starter, for valve adjustment, for example, first disconnect the cables at the junction boxes for the engine control system and turn the ignition key to “0” to avoid any risk of accidentally starting the engine. Check the wiring diagram to be sure that the correct cables are disconnected. See “Instructions for running on starter”.
NOTE: For specifications, see “Technical Data, TAD1240GE, TAD1241GE/VE, TAD1242GE/VE and TWD1240VE”.

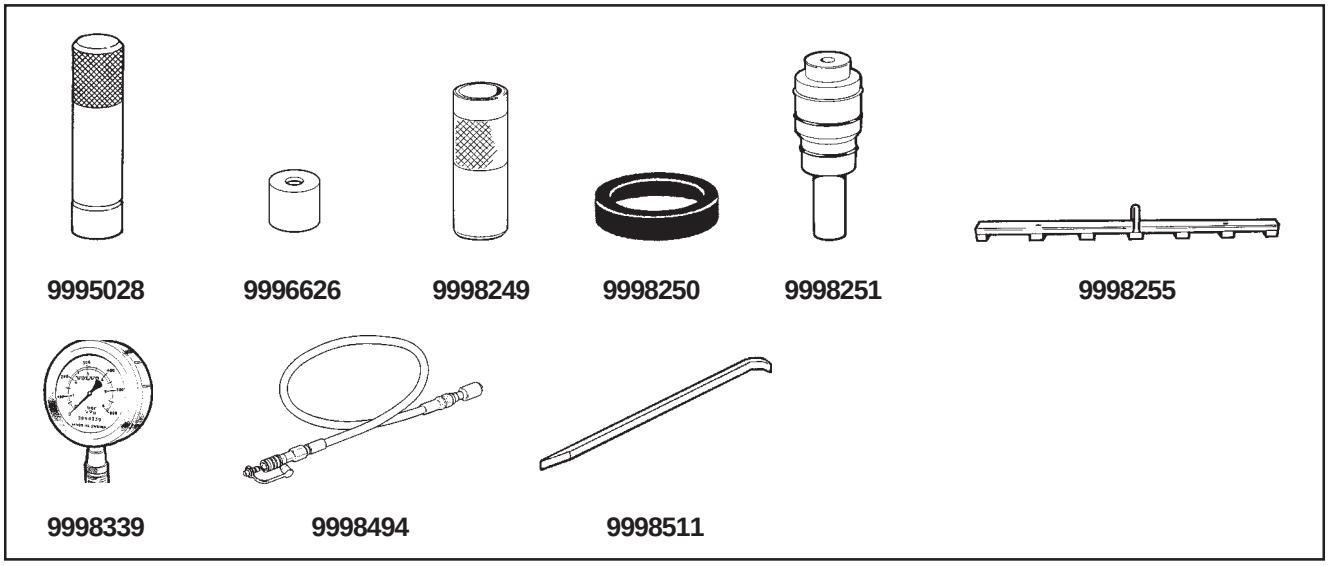
Instructions for working with electronic fuel injection

- Never remove the control module connectors or any electrical cable from the sensors when the engine is running. The ignition key should be in the “0” position and the engine stopped.
- Never disconnect any battery cables when the engine is running.
- Disconnect the control module connector from the control module when doing any electrical welding work on the engine.

  NOTE: The main power must be turned off before the connectors are disconnected.
- Only batteries should be used for starting. Starter packs can cause voltage surges and damage the electronics.
- For quick battery charging, disconnect the battery cables. (This does not apply to normal maintenance charging.)
- If any connectors are disconnected, be sure that they are reconnected properly and that they are free from oil and other contamination which can cause poor contact.

Tools

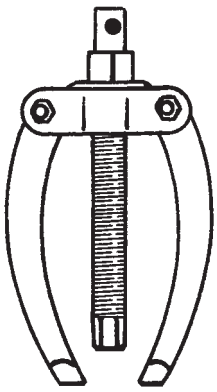
Special Tools



Tool	Name, use
9995028	Drift pin
9996626	Sleeve pin
9998249	Protective sleeve
9998250	Ring seal
9998251	Protective plug
9998255	Lifting bar
9998339	Pressure gauge
9998494	Connector nipple
9998511	Pry bar

Other special tools

981 2546



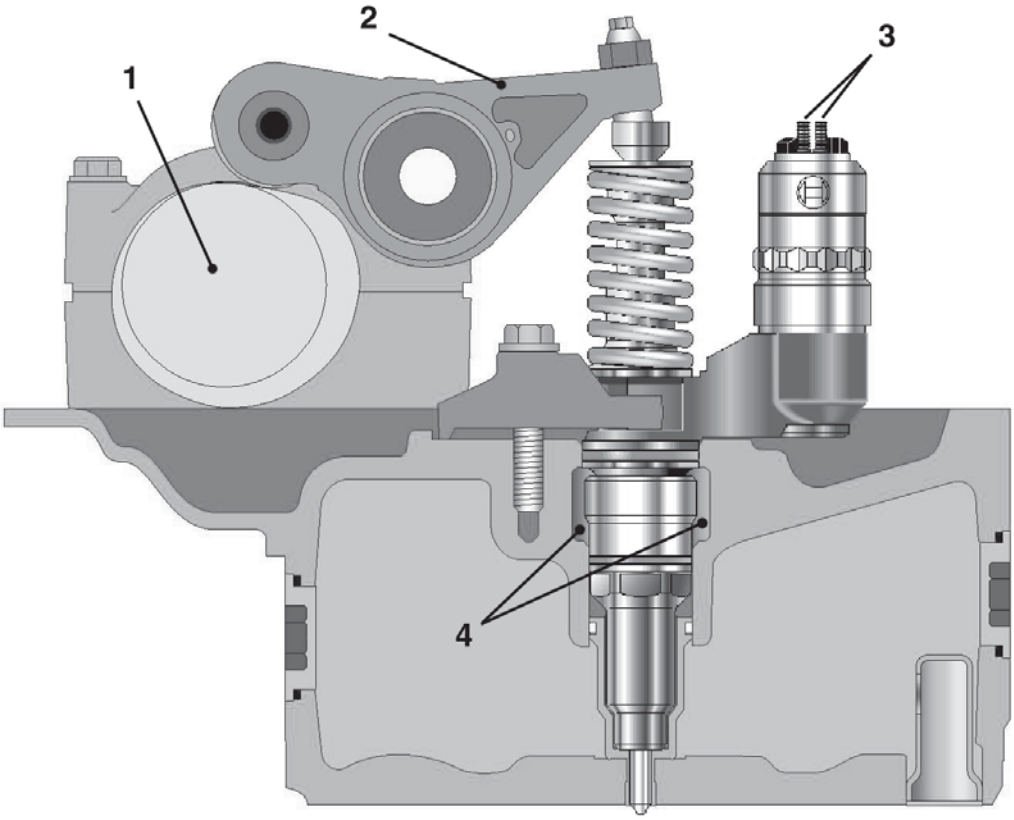
998 6173

998 6177

981 2546 Cleaning brush
998 6173 Puller
998 6177 Extractor

Design and Operation

Unit injectors, overview



1. Camshaft
2. Rocker arm
3. Electrical connection for injector unit
4. Fuel passage

Unit injectors, working phases

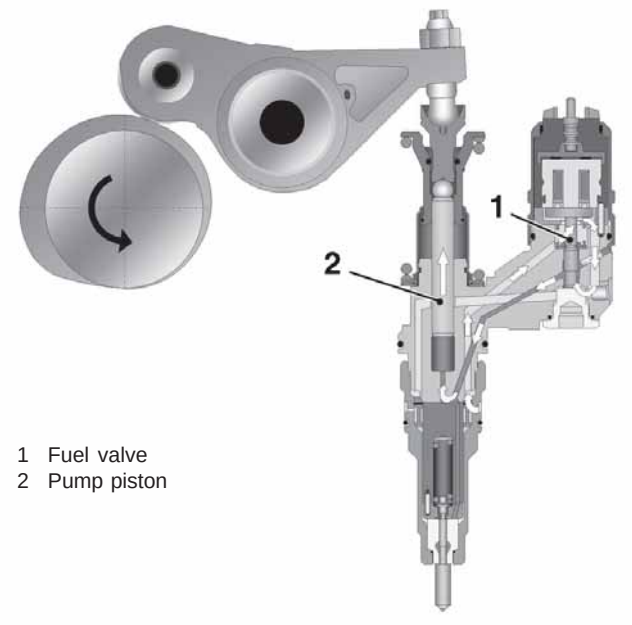
Filling phase

During the filling phase, the pump piston (2) is moving up to its top position.

The camshaft high point is passed and the cam follower is moving towards the base of the cam.

The fuel valve (1) is open and fuel can flow into the pump cylinder from the lower fuel passage in the cylinder head and into the injector unit pump cylinder.

Filling continues until the pump piston reaches its top position.



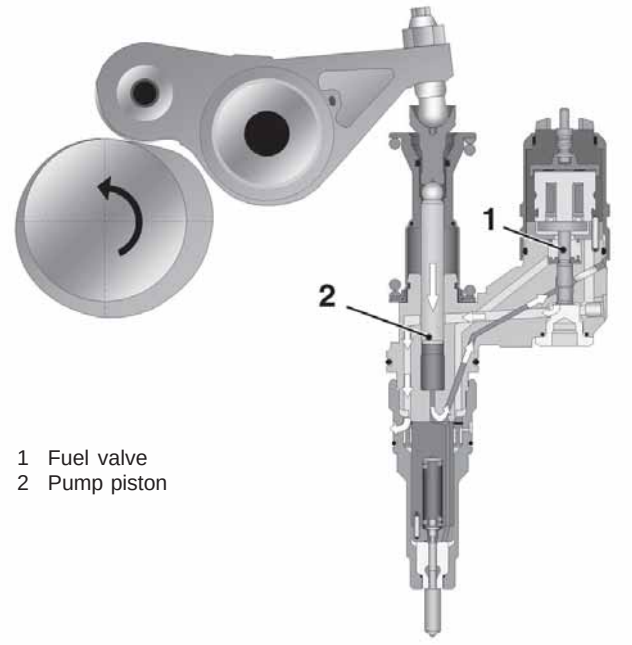
1 Fuel valve
2 Pump piston

Spill phase

The spill phase begins when the camshaft is turned to the position where the cam, via the rocker arm, begins to press the piston (2) down.

Fuel can now flow through the fuel valve (1), through the hole in the injector and out through the fuel passage.

The spill phase continues as long as the fuel valve (1) is open.

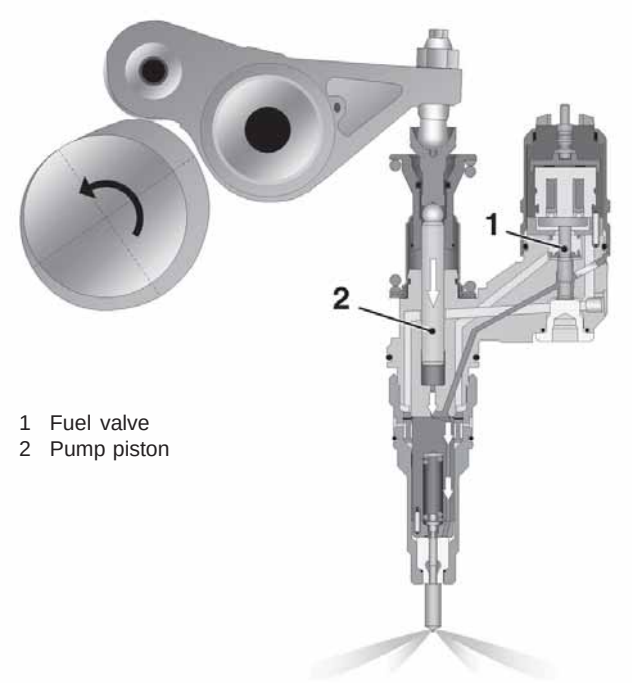


1 Fuel valve
2 Pump piston

Injection phase

The injection phase begins when the fuel valve (1) closes. The cam on the camshaft continues to press the piston (2) down via the rocker arm and injection takes place as the passage through the fuel valve is closed.

The injection phase continues as long as the fuel valve (1) is closed.



1 Fuel valve
2 Pump piston

Pressure release phase

Injection stops when the fuel valve opens and the pressure in the injector falls below the opening pressure of the atomizer.

The fuel flows through the open valve, through the injector hole and out through the fuel passage.

Note that it is the position of the fuel valve (closed or open) which determines when injection begins and ends.

The duration for which the fuel valve is closed determines the quantity of fuel injected on each pump stroke.

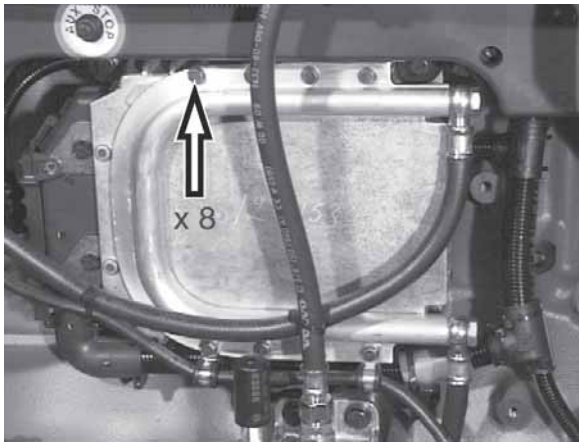
Repair instructions

Control module (EDC III), changing

1

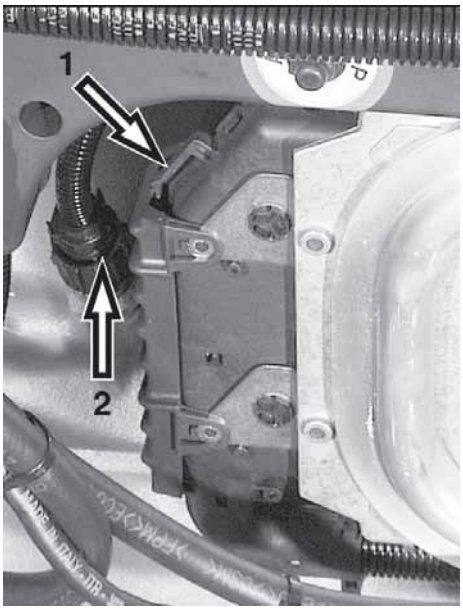
Disconnect power to engine.

2



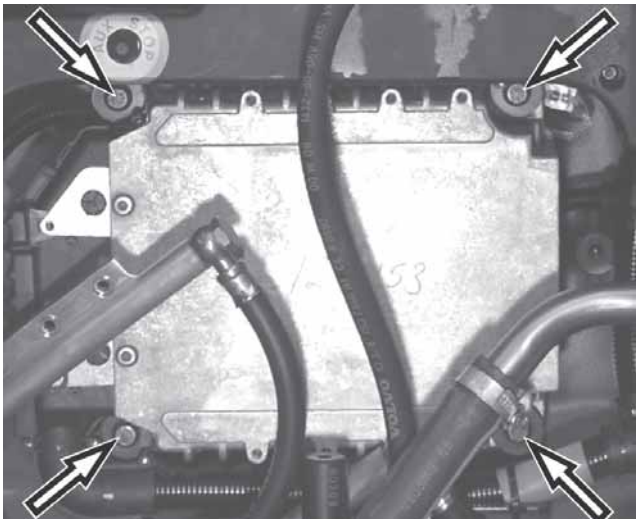
Remove the fuel cooling loop and the clamps on the fuel lines from the control module. Fold the cooling loop to one side.

3



Disconnect the wiring connector from the control module. Push out on the latch (1) and pull the connector (2) upward.

4

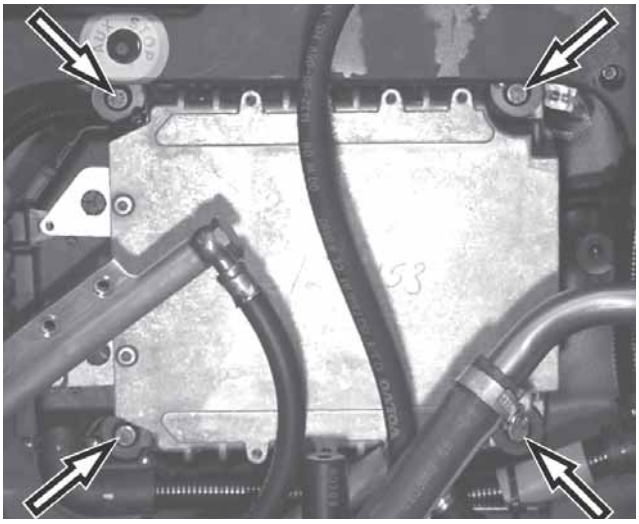


Remove the control unit.

5

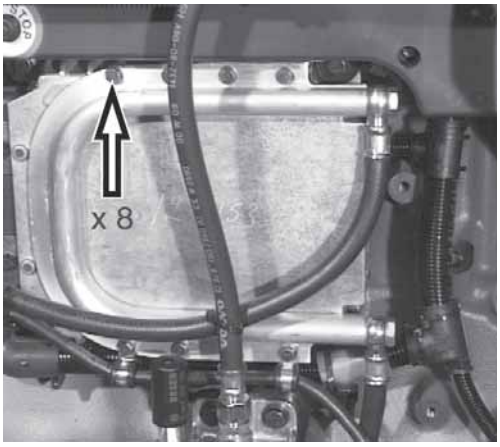
Transfer the four rubber mounts to the new control module.

6



Install the new control module.

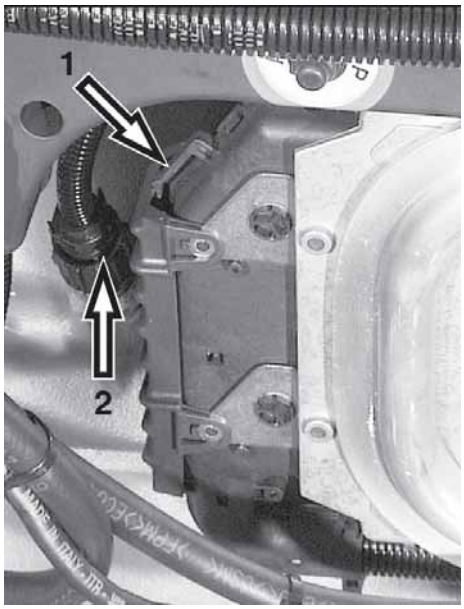
7



Connect the fuel cooling loop and the clamps for the fuel lines on the control module.

NOTE: The mounting screws for the fuel cooling loop are self-tapping: there are no threads in the control module.

8



Connect the connector to the control module. Plug the connector (2) into the control module so that the safety latch (1) can be engaged.

9

Start the engine and perform a leakage and functional check.

Fuel system, draining

1

Clean carefully around the cylinder head vent nipple and fuel filter bracket draining nipple.

2

Connect a plastic hose to the fuel filter bracket draining nipple and open the nipple (2).

3

Open the vent nipple on the cylinder head. Allow fuel to drain into a container.

NOTE: For fuel filter, changing. Only perform steps 1–3 in the fuel draining procedure.

4

When the fuel has finished flowing out, open the vent nipple (1) on the fuel filter bracket and allow the fuel to drain into a container.

NOTE: Be careful when handling fuel and make sure that it is disposed of properly.

Fuel filter, changing

NOTE: Do not fill the new filter with fuel before installing as there is a risk of contamination entering the system and causing running problems or damage.

1

Clean around the fuel filter.

2

Drain the fuel filter, see “Fuel filter, draining”.

3

Remove the filter using an appropriate filter wrench.

4

Clean the filter contact surface on the filter housing.

5

Spread a thin layer of engine oil onto the gasket and install the new fuel filter. Tighten the fuel filter according to the instructions on the filter.

6

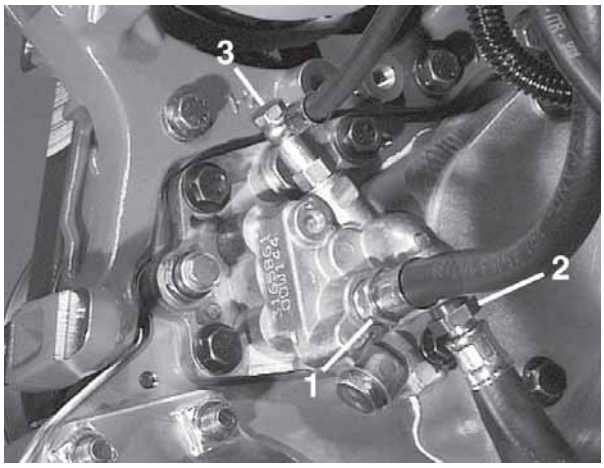
Bleed the fuel system at the filter, see “Fuel system, bleeding”.

7

Run the engine at fast idle for about 10 minutes to evacuate any remaining air from the system. Perform a leakage and functional check.

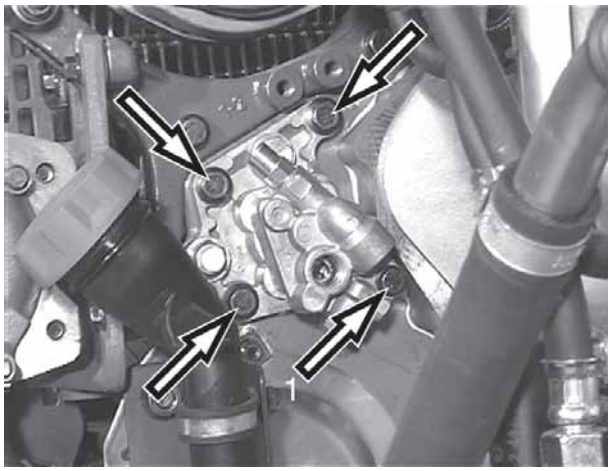
Fuel pump, changing

1



Clean around the fuel pump. Disconnect fuel lines 1, 2 and 3.

2

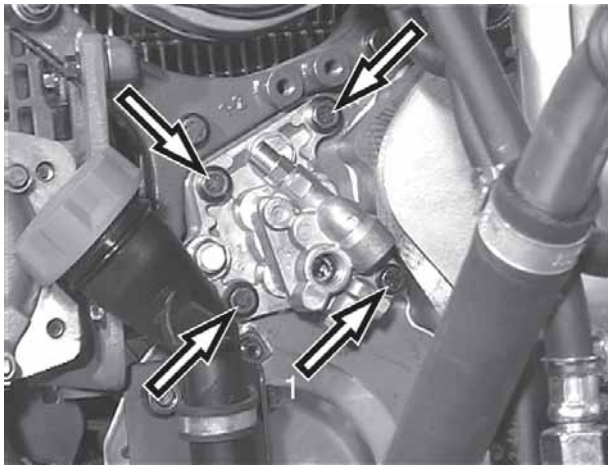


Remove the fuel pump.

3

Clean the contact surface on the transmission plate.

4

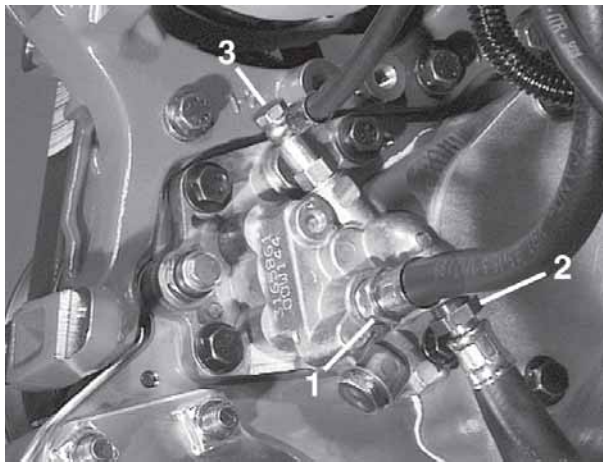


NOTE: Spread a thin layer of graphite grease around the O-ring on the drive shaft before installing the fuel pump.

Check that the new fuel pump drive shaft fits into the transmission. Install the fuel pump with a new gasket and apply thread tape to the bolt (1).

NOTE: The bolt (1) comes with thread tape, see fuel pump packaging.

5



Connect fuel lines 1, 2 and 3 with new gaskets.

6

Bleed the fuel system and filter, see “Fuel system, bleeding”.

7

Run the engine at high idle for about 10 minutes to evacuate any remaining air from the system.

8

Carry out a leakage and functional check.

Fuel pump, rebuilding

The instructions below refer to the parts locations numbers shown in the figures.

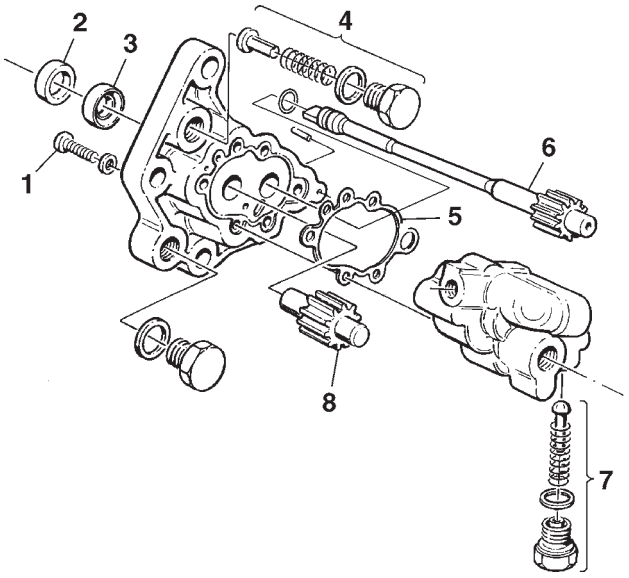
Check all parts for damage and wear.

Always replace any parts that are damaged or worn.

Parts that are not replaced must be cleaned very thoroughly.

Special tools: 9996626, 9995028

Other special equipment: 9986173, 9986177



1

Remove the valves (4 and 7).

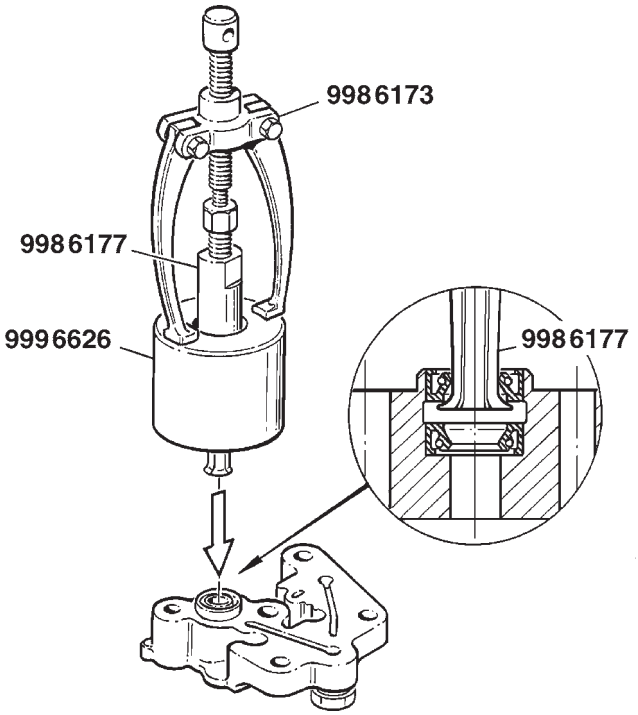
2

Remove the bolts (1) and take apart the housing.

3

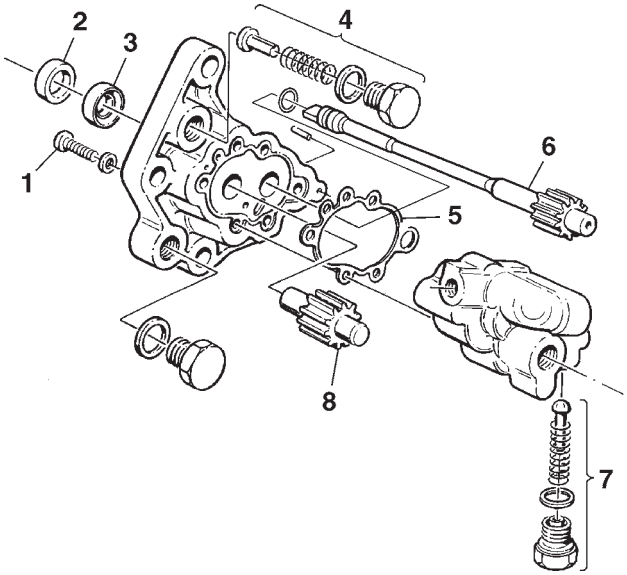
Remove the pump impellers (6 and 8) and the gasket (5).

4



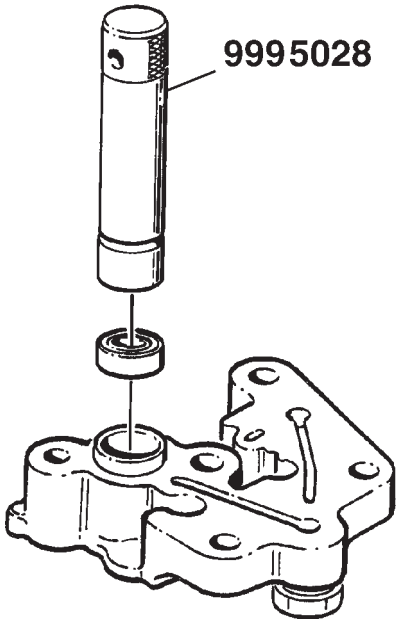
Remove the seals (2 and 3) from the impeller shafts with puller 9986173 and extractor 9986177. Use sleeve pin 9996626.

5



The instructions below refer to the parts locations numbers shown in the figures above.

6

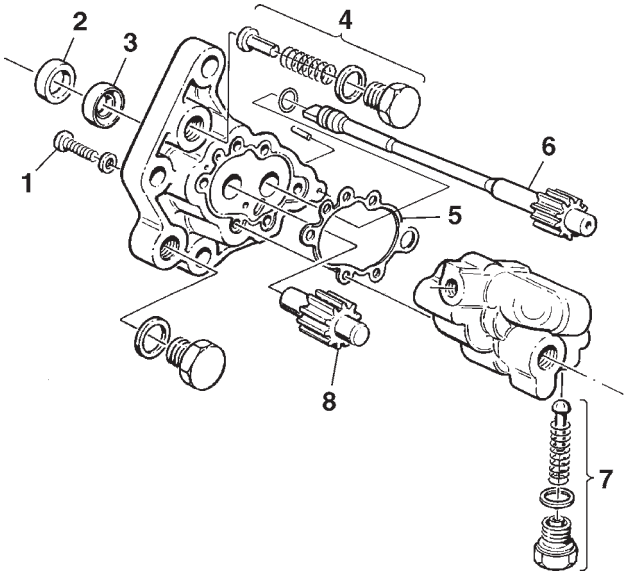


Press in the inner and outer seals (3 and 2) for the pump drive shaft with pin 9995028.

The inner seal should be pressed down to the bottom and the outer seal flush with the housing.

NOTE! The seals should be positioned with their sealing lips away from one another.

7



Install a new gasket (5).

8

Dip the pump impellers (6 and 8) in diesel oil and insert them into the housing.

9

Check that the gasket (5) is seated properly in its groove and bolt the housing back together.

10

Install the valves (4 and 7). Use new sealing washers.

11

Insert protective plugs into the openings of the fuel pipes.

Fuel system, bleeding

1

Clean the vent nipples on the cylinder head and on the fuel filter bracket.

2

Bleed the fuel system and filter. Connect a transparent plastic hose from the bleeder nipple (1) to a container.

Open the bleeder nipple on the fuel filter bracket.

Pump with the manual pump until fuel flows without air bubbles. Tighten the bleeder nipple while fuel is flowing.

3

Remove the hose and replace the protective cap on the bleeder nipple.

NOTE: When changing the fuel filter only, no further bleeding is necessary.

4

Transfer the hose to the cylinder head bleeder nipple and bleed in the same way as at the fuel filter bracket.

5

Run the engine at fast idle for about 10 minutes to evacuate any remaining air from the system.

6

Perform a leakage and functional check.

Bypass valve, changing

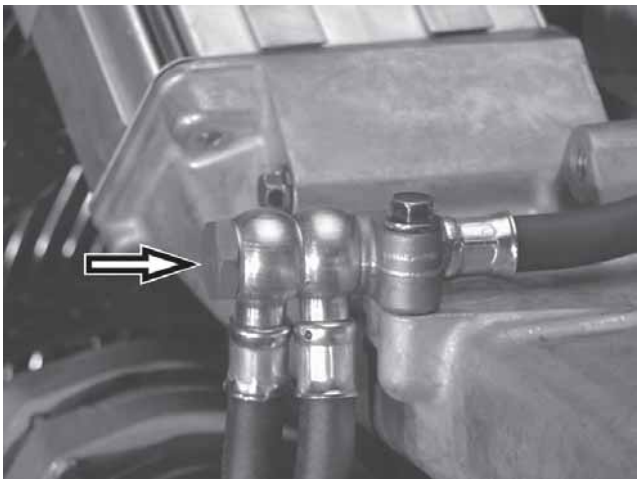
1

Clean thoroughly around the bypass valve.

2

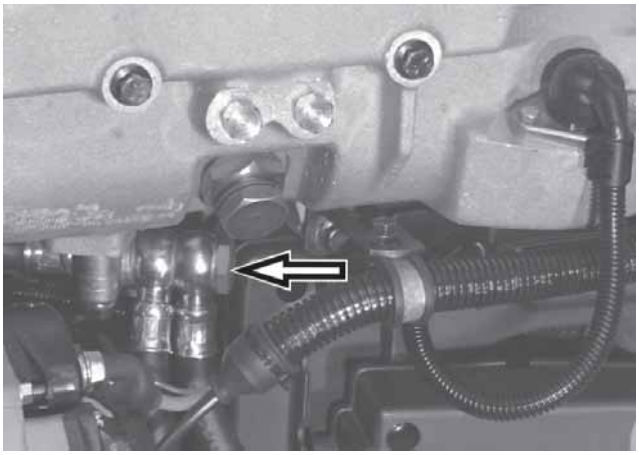
Drain the fuel system, See “Fuel system, draining.”

3 (TAD)



Remove the bypass valve.

3 (TWD)



Remove the bypass valve.

4

Clean the connectors on the fuel hoses.

Install a new bypass valve and gaskets. Torque to 55 ± 5 Nm (40 ± 4 ft-lbf)

5

Bleed the fuel system. See “Fuel system, bleeding.”

6

Run the engine at fast idle for about 10 minutes to evacuate any remaining air from the system.

7

Perform a leakage check.

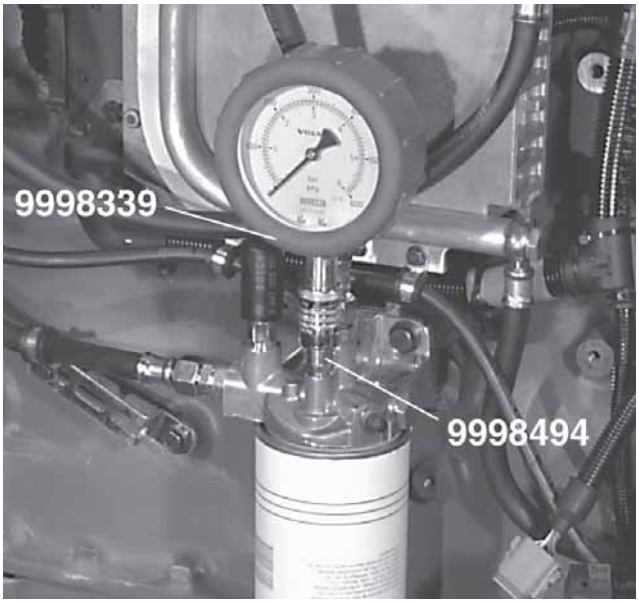
Fuel pressure, checking

Special tools: 9998339, 9998494

1

Clean the fuel filter bracket carefully.

2



Remove the bleed nipple and install connector nipple 9998494. Connect pressure gauge 9998339.

3

Start the engine and run it at 1000 RPM until the fuel pressure on the pressure gauge has stabilized.

4

Compare the measured pressure with the fuel pressure given in the table below.

Fuel pressure	
After fuel filter at 1000 RPM, min	350 kPa (50 psi)
After fuel filter at full load, min	350 kPa (50 psi)

5

When the check is completed, remove the measurement equipment and bleed the fuel system. See “Fuel system, bleeding.”

Unit injectors, changing

Special tools: 9998249, 9998250, 9998251, 9998255, 9998511

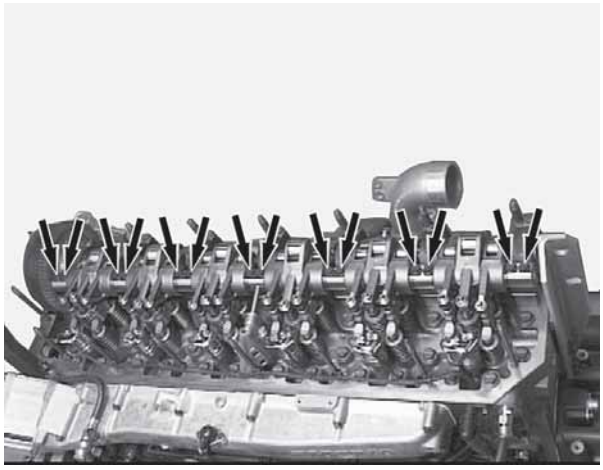
Other special equipment: 9812546

1

Remove valve cover.

NOTE: Do not use air tools as the studs can come loose and the injector wiring insulation can be damaged.

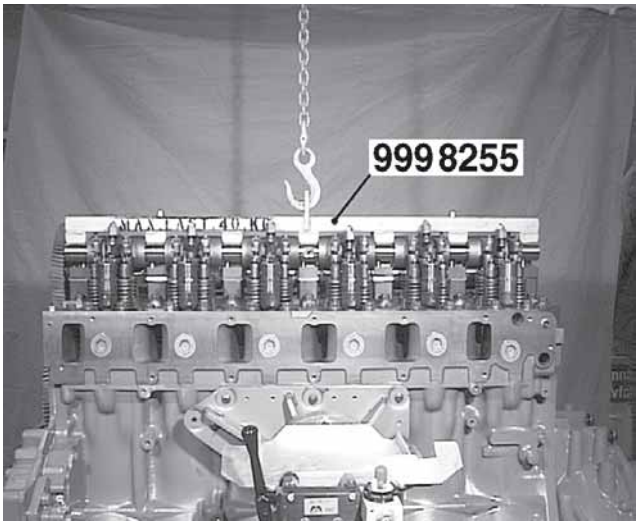
2



Remove all the adjustment bolts for the rocker arms and the valves. Remove all the bolts on the rocker arm bridge.

NOTE: Loosen the bolts on the rocker arm bridge evenly along the entire bridge to avoid distortion.

3



Lift out the rocker arm bridge using lifting bar 9998255.

NOTE: If no lifting bar is available, the rocker arm bridge should be lifted by two persons to avoid injury and damage.

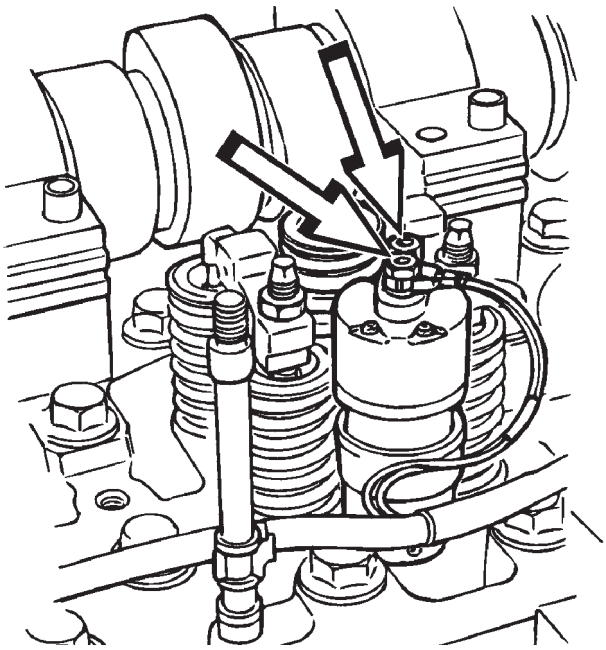
4

Drain the fuel from the cylinder head as instructed. See “Fuel system, draining”.

5

Clean very carefully around the injectors to be replaced.

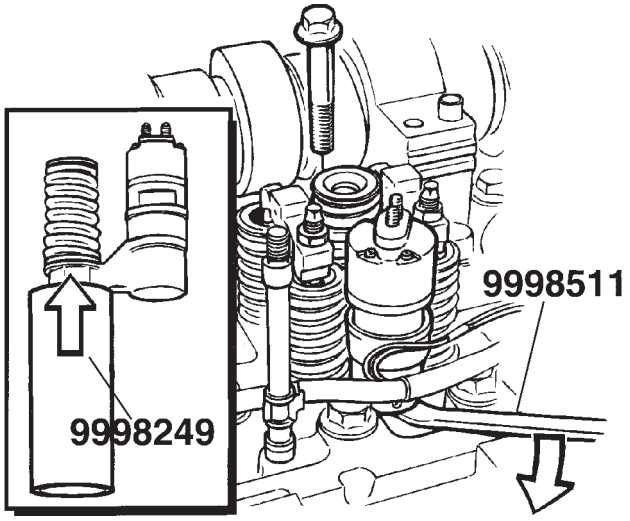
6



Disconnect electrical wires from the injector.

⚠ **IMPORTANT!** Be careful when connecting or disconnecting the wiring to the injectors.

7

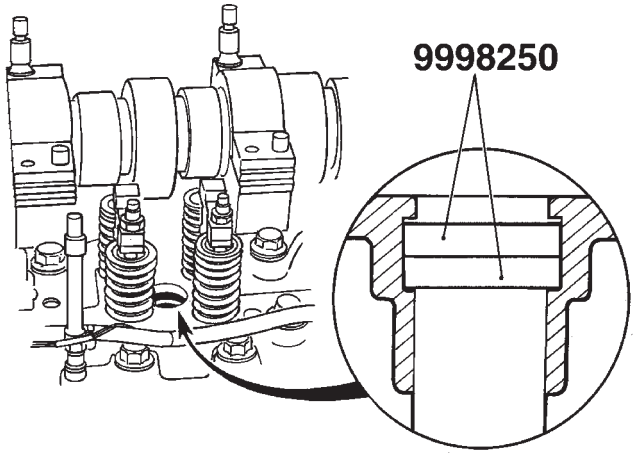


Remove the injector using pry bar 9998511 if required.

Check that no contamination gets down into the fuel chamber in the cylinder head.

Install protective sleeve 9998249 onto the injector.

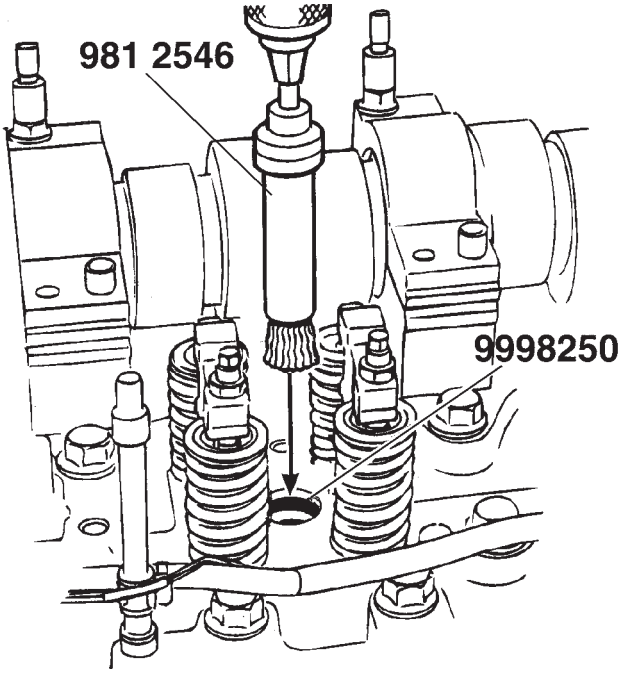
8



Install 2 ea. ring seals 9998250 in the cylinder head fuel groove.

NOTE: Be sure that the sealing rings are well cleaned and correctly seated.

9

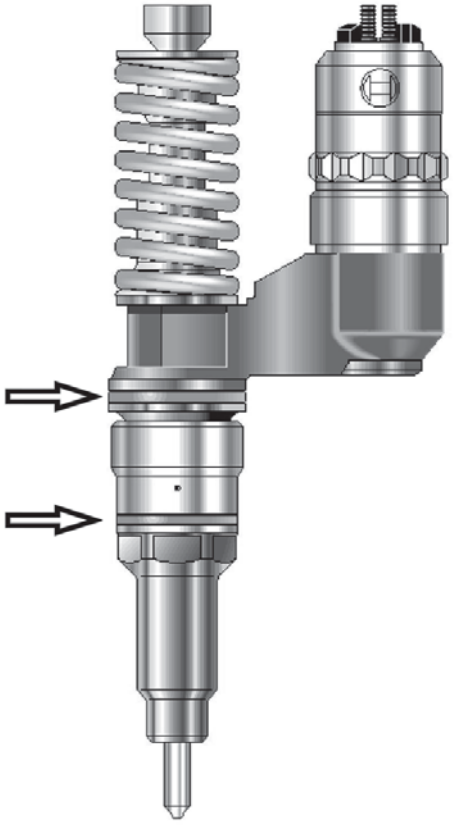


Clean the copper sleeve. Use a hand drill and cleaning brush 9812546.

10

Clean the injector hole in the cylinder head very carefully and remove sealing rings 9998250.

11



Install new sealing rings on the injector and check that they are correctly seated.

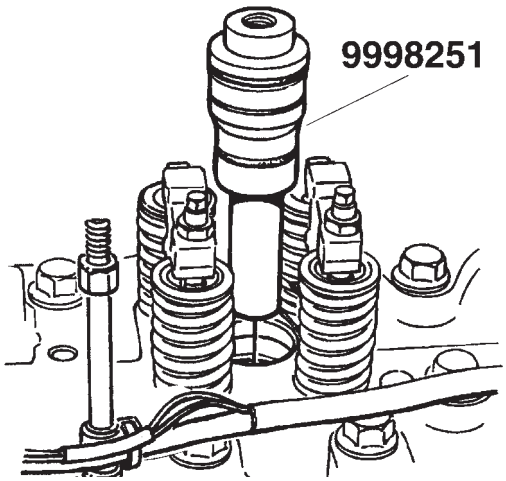
Lubricate the rings with engine oil.

Install the injector, forcing it down until it seats and center it between the valve springs.

Tighten the injector to the torque and angle specified. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

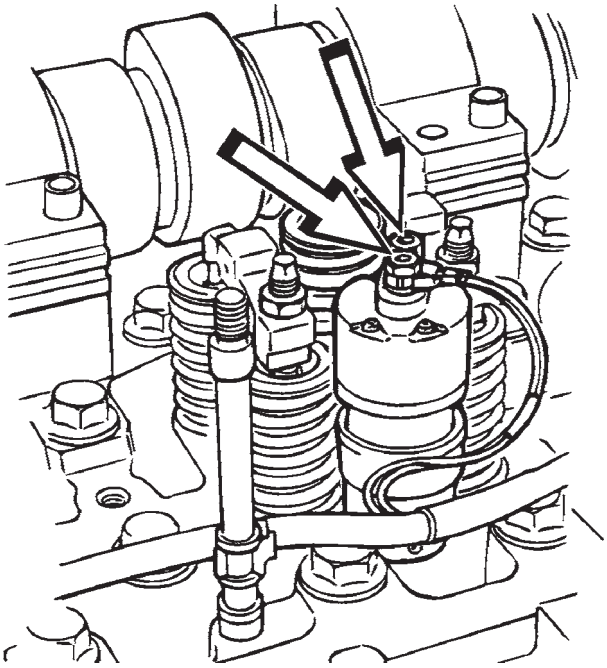
NOTE: Different tightening torques apply depending on whether or not the injector’s copper sleeve has been replaced.

12



If the injector is not installed immediately, insert a protective plug 9998251 into the cylinder head hole.

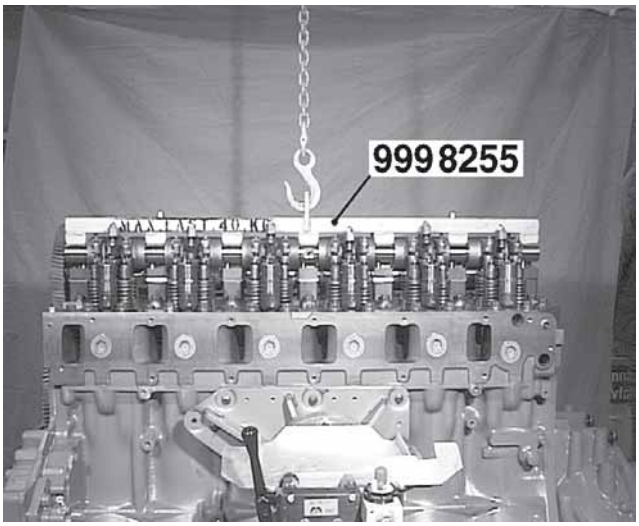
13



Connect the electrical wires to the injector and tighten the nuts to max. torque 1.5 Nm (1 ft-lbf).

NOTE: If the nuts are overtightened, the solenoid valve can be damaged and the entire injector will have to be replaced.

14



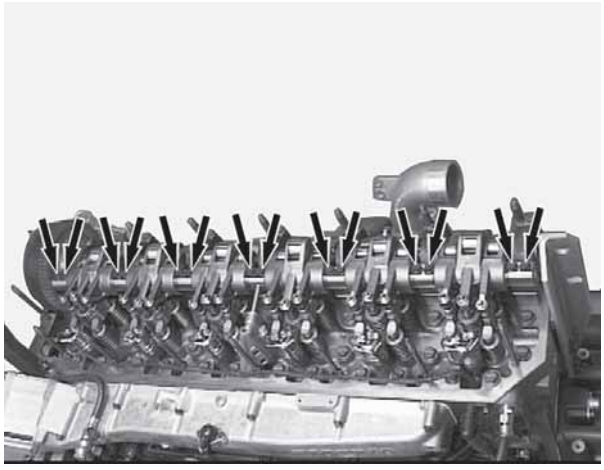
Oil the valve yokes and cams with engine oil.

Lift the rocker arm bridge into position using lifting bar 9998255.

Be sure that the valves and rocker arms mate correctly.

NOTE: If no lifting bar is available, the rocker arm bridge should be lifted by two persons to avoid injury and damage.

15



Tighten the bolts on the rocker arm bridge evenly along the entire bridge to avoid distortion.

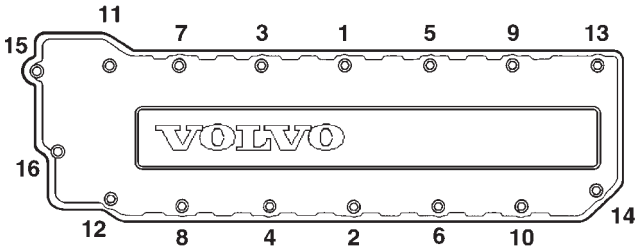
Be sure that the rocker arm shaft fits correctly into the guide sleeves on the camshaft bearing blocks and tighten the bolts so that the shaft is snug against the bearing blocks.

Then tighten the bolts on the rocker arm bridge to the torque specified in the tightening instructions. See “Technical Data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE and TWD1240VE”.

16

Adjust the valves and injectors. See “Valves and unit injectors, adjustment”.

17



Install the valve cover and torque the nuts to 20 ± 2 Nm (15 ± 2 ft-lbf) in the order shown in the diagram.

NOTE: It is important to torque the valve cover nuts as shown in the diagram to avoid cracking the cover and to prevent the studs from loosening in the cylinder head.

If any stud in the valve cover came loose from the cylinder head when the nuts were removed, check the wiring insulation by the injectors. There is a risk that the cable holder on the stud will twist and damage the wiring insulation.

18

If any stud has come loose, it must be removed, cleaned and coated with locking compound item no. 1610532 before being replaced and tightened.

Do not loosen the stud bolts or nuts until the locking compound has set.

NOTE: Install the studs within 20 minutes after applying the locking fluid.

19

Bleed the fuel system. See “Fuel system, bleeding”.

20

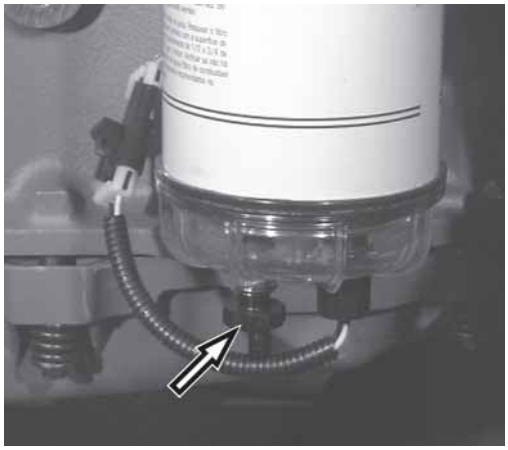
Run the engine at fast idle for about 10 minutes to evacuate any remaining air from the system.

21

Perform a leakage and function check.

Draining condensate water

1



NOTE: Place a container under the fuel pre-filter to collect the condensate water and fuel.

Open the drain nipple at the bottom of the fuel pre-filter and let the condensate water run out.

2

Tighten the drain nipple when water-free fuel runs out.

3

Start the engine and let the engine fill the water separator with fuel. Let the engine run for 10 minutes at idle so that any air remaining is forced out of the fuel system.

4

Shut down the engine and check for leaks.

Fuel pre-filter with water monitor, changing

1

Clean around the fuel filter.

2

Disconnect the water monitor.

3

Drain the fuel filter, see “Fuel system, draining”.

4

Remove the fuel filter with an appropriate filter wrench.

NOTE: Unless the entire filter unit with water monitor is to be replaced, the water monitor should be transferred to the new fuel filter.

5

Clean the filter contact surface on the filter housing.

6

Spread a thin layer of engine oil onto the sealing ring and install the new fuel filter according to the instructions on the filter.

7

Connect the water monitor.

8

Start the engine and check for leaks.

21191

Copper sleeve for unit injector, change

NOTE: Two different variants of copper sleeve can occur on the D12C. **Always check the variant of copper sleeve that is installed in the cylinder head before work starts, to ensure that the correct special tool is used.** Please refer to item 7 on the next page.

Special tools: 999 0185, 999 3590, 999 8249, 999 8250, 999 8252, 999 8253, 999 8599**, 999 8688*

* Threading tool 999 8252 includes thread tap 980 9667 (M9) and 998 7009 (M8).

** Cleaning kit 999 8599 includes: 276 948, 959 239, 980 8570, 999 8580 with holder, and brush kit 980 8634.

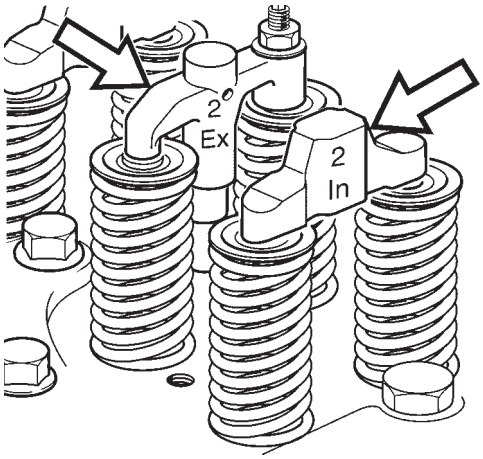
1

Drain the coolant as appropriate. “Cooling system, draining” on page 49.

2

Remove the unit injector when the copper sleeve is to be changed. Please refer to “Unit injector, changing”, page 175.

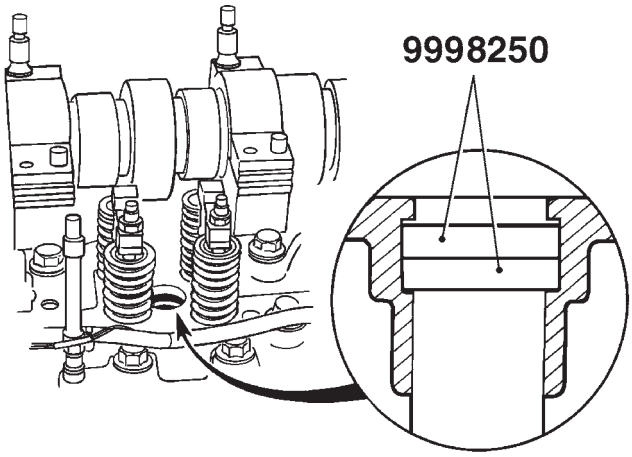
3



Remove the valve yokes beside the copper sleeve to be changed.

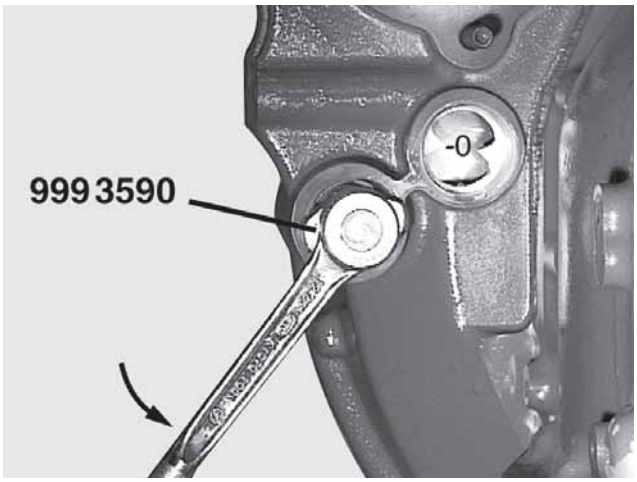
NOTE: Mark the valve yokes so that they can be put back in the right places.

4



Install two seal rings 999 8250 in the cylinder head fuel gallery, as a protection against dirt.

5



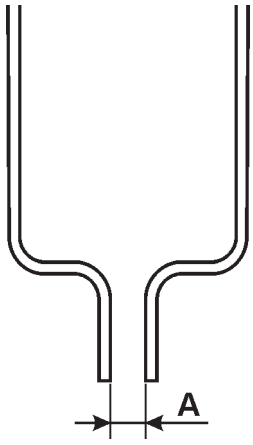
Install turning tool 999 3590.

6

Crank the engine until the piston is at **TDC** for the cylinder where the copper cylinder is to be changed.

NOTE: This must be done to prevent the drill from falling down into the cylinder when the sleeve diameter is checked (next task).

7



Check diameter “A” of the copper sleeve to be changed, using a drill (Ø 7.5 mm / 0.295").

NOTE: The copper sleeve must be free from soot.

If the drill can be passed through the hole, this means that the copper sleeve has a diameter “A” = 7.8 mm (0.307").

If the drill does **not** pass through the hole, or only with some resistance, the copper sleeve diameter “A” = 7.4 mm (0.291").

⚠ **IMPORTANT!** Turn the piston away from TDC once the correct diameter has been found, to prevent the tools from touching the piston crown.

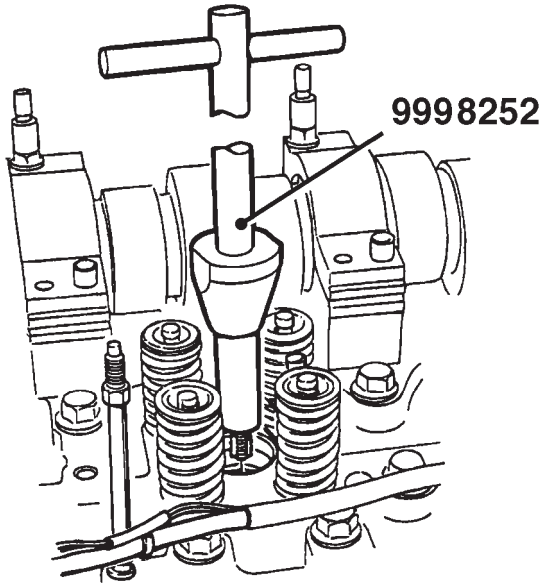
8

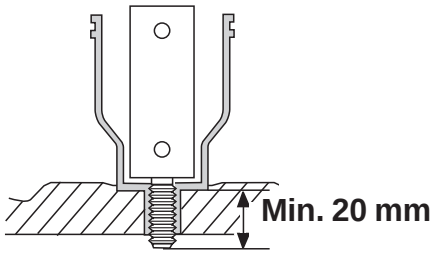
Put tap No. 980 9667 (M9) in tool 999 8252 if diameter “A” was measured as 7.8 mm (0.307").

Use tap No. 998 7009 (M8) if the diameter is 7.4 mm (0.291").

The tip of the tap should project 20 mm (0.8") beyond the tip of the tool rod.

9





Carefully tap a thread in the copper sleeve, using tool 999 8252 and a suitable tap, as in point 8.

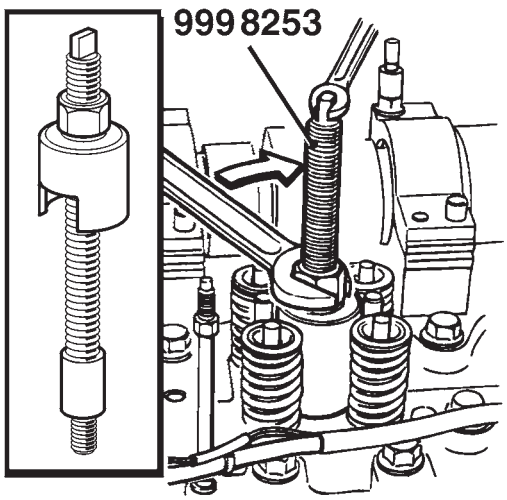
NOTE: Grease the thread tap, to prevent swarf from falling down into the cylinder.

Screw the tap in at least 20 mm (0.8") past the tip of the copper sleeve.

10

Remove the tap.

11

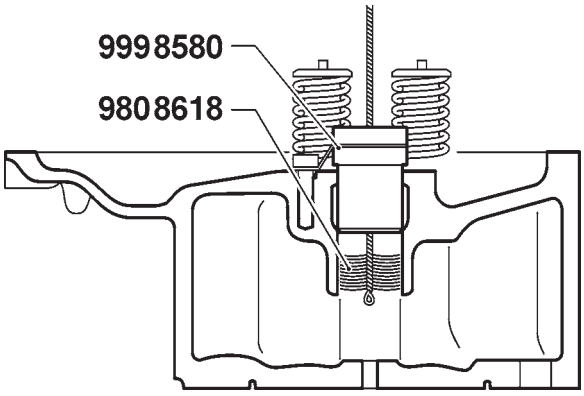


NOTE: Screw the nose of extractor 999 8253 in **at least 15 mm** (0.6") into the copper sleeve.

Remove the copper sleeve by carefully turning the nut at the same time as the spindle is held tight.

NOTE: Use 980 9668 (M9) or 980 9746 (M8), depending on the diameter of the hole in the copper sleeve.

12

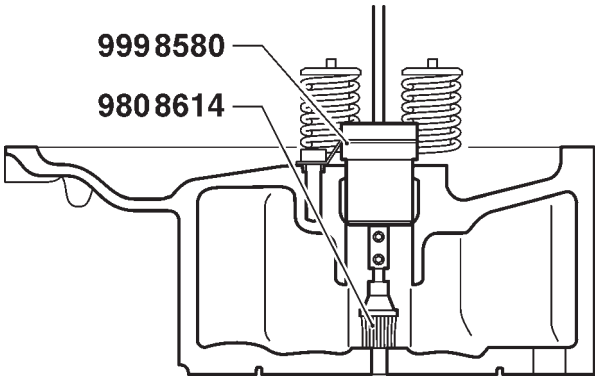


Carefully clean the sealing surface in contact with the O-ring on the copper sleeve. Use cleaning kit 999 8599 and an electric drill

NOTE: Install sleeve 999 8580 with holder* into the injector well, to prevent dirt from coming down into the fuel duct.

*** Note.** The “lugs” must be cut off the holder to get the tool to fit.

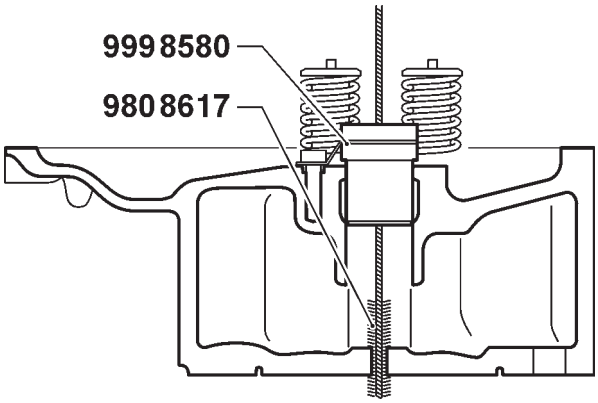
13



Carefully clean the seat for the copper sleeve in the cylinder head. Use brush 980 8614 together with a shaft and holder.

NOTE: Install sleeve 999 8580 with holder must remain in the injector well, to prevent dirt from coming down into the fuel duct.

14



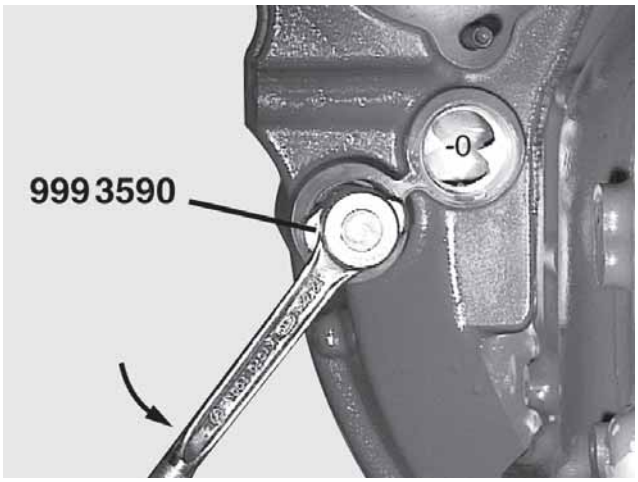
Carefully clean the seat for the copper sleeve tip, with brush No. 980 8617.

NOTE: Sleeve 999 8580 with holder must remain in the injector well, to prevent dirt from coming down into the fuel duct.

15
Check that there is no contamination left in the cylinder head. Remove sleeve 999 8580 and holder.

Undo the two seal rings 999 8250 from the fuel gallery in the cylinder head.

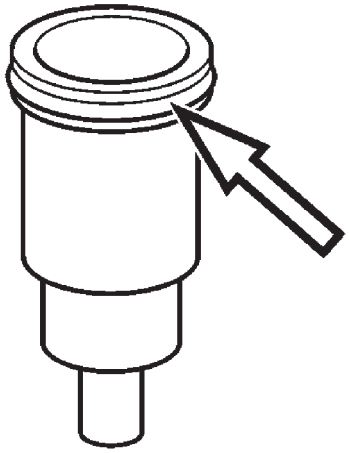
16



Crank the engine until the piston is in its **lower** position in the cylinder.

⚠ **IMPORTANT!** This must be done so that tool No. 999 8688 will not damage the piston, due to its length, when the copper sleeve is expanded.

17



Lubricate the new seal ring for the copper sleeve with **soapy water** and put it on the copper sleeve.

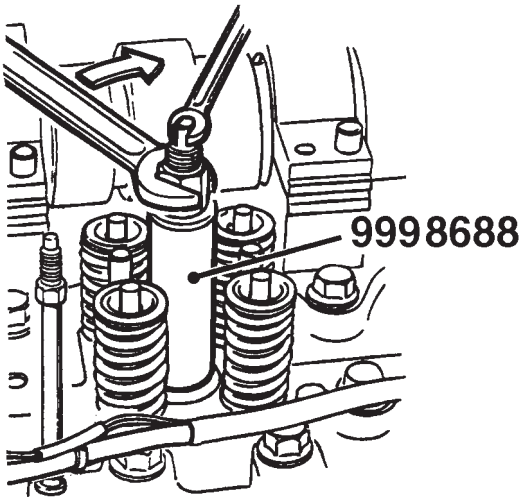
NOTE: Always use a new O-ring.

18
Put the copper sleeve on expansion tool 999 8688. Lubricate the expansion tool with oil.

19
Carefully press the copper sleeve down so that the expansion tool locates against the area for the unit injector (edge) in the cylinder head.

Install the unit injector yoke and tighten it. Check that the copper sleeve “bottoms” in the cylinder head.

20



Spread the copper sleeve by turning the nut at the same time as the spindle is kept still, until the expansion tool has been completely pulled through.

21
Remove the expansion tool.

22
Put the valve yoke back in accordance with the previous marking.

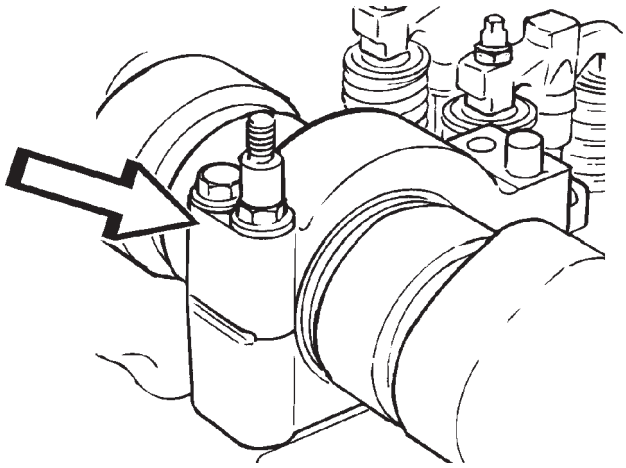
23
Install the unit injector. Please refer to “Unit injector, changing”, page 175.

24
Install the rocker arm bridge and check the clearance of the valves and unit injectors. Please refer to the instruction on the page 106.

25
Install the valve cover. Please refer to the torque schedule in “Technical Data”. Tightening torque: **20 ±2 Nm** (15 ±1.5 lbf.ft.).

26
Fill up with coolant and do a leakage test if the work has not been done on a loose cylinder head.

Bearing housing for camshaft, change

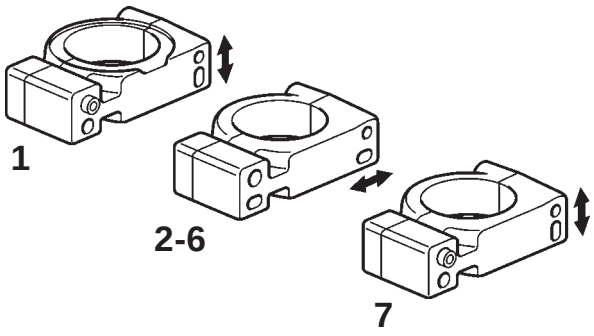


The production-installed bearing housings are machined together with the cylinder head, and can therefore not be moved from one cylinder head to another one.

If a bearing housing is damaged, a replacement housing can be installed. **All bearing housings must then be changed, so that the bearing housing positions can be aligned.**

The holes in the replacement housings are oval, which allows the center bearing housings to be adjusted radially, and the front and rear housings to be adjusted axially.

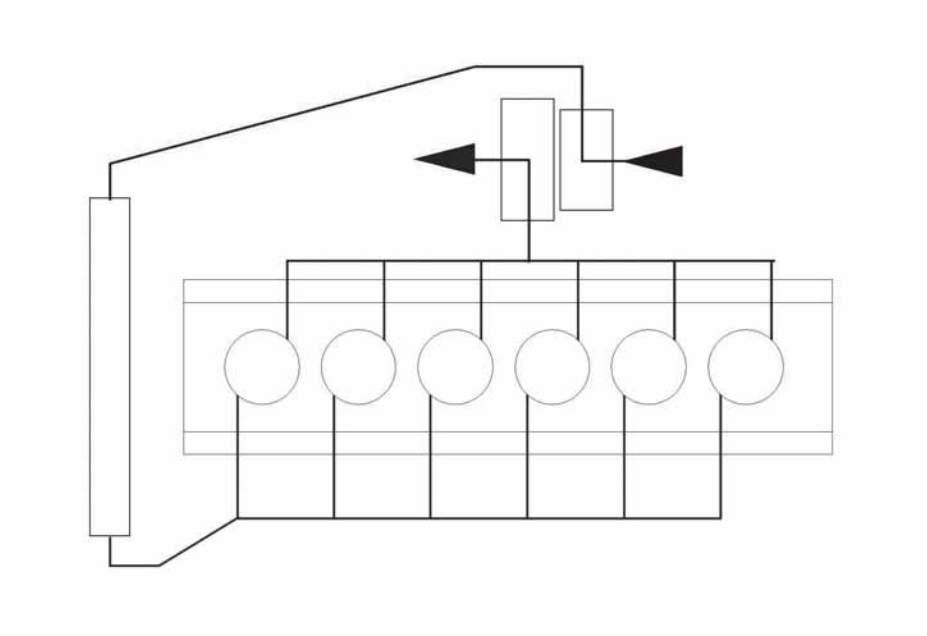
If the cylinder head is already equipped with replacement housings, a damaged housing can be changed without needing to change the other housings.

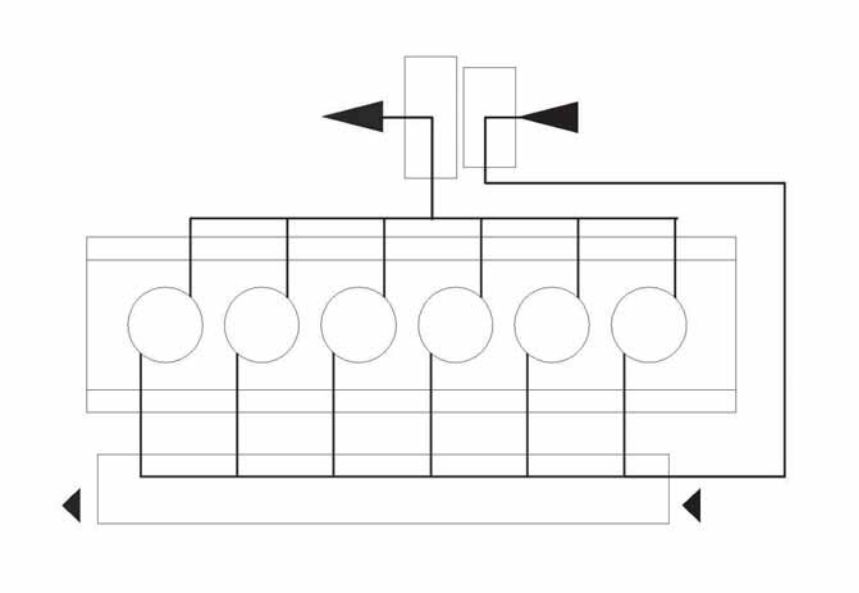


Replacement housings can be recognized since they have oval holes for the guide sleeves.

If a replacement housings are installed, mark them with their numbers, so they can be put back in the same place as before, if they have to be removed.

Group 25 Intake and Exhaust Systems





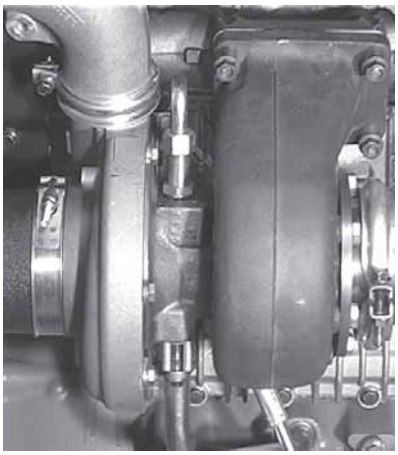
Design and Operation

Turbocharger

The turbocharger is driven by exhaust gases which pass through the turbine housing on their way out to the exhaust system.

The exhaust gas flow causes the turbine wheel in the housing to rotate. The compressor wheel is mounted on the same shaft as the turbine wheel. The compressor wheel is placed in a housing which is connected between the air filter and the engine intake manifold.

When the compressor wheel rotates, air is drawn from the air filter. The air is compressed and forced into the engine cylinders after first being cooled while passing through the charge air cooler.



Repair instructions

Working with chemicals, fuel and lubricating oil

IMPORTANT! Apply barrier cream to hands and always wear protective gloves for work where there is a risk of contact with oil, fuel or the like. Continual skin contact with engine oil dries out the skin and can be harmful.

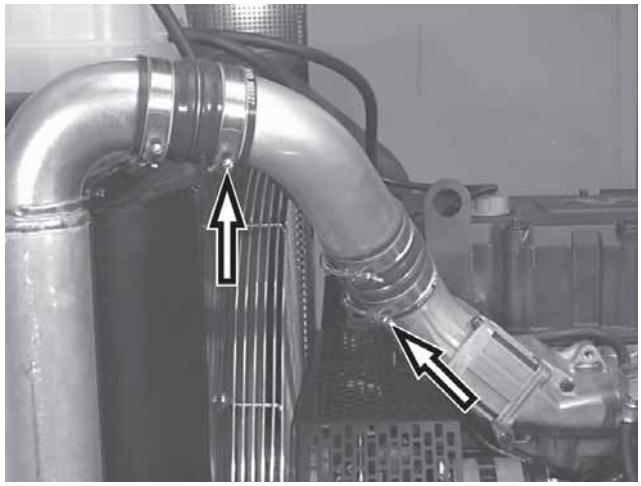
Intake manifold (gasket), changing

TWD: Drain the cooling system, see “Cooling system, draining ”.

1

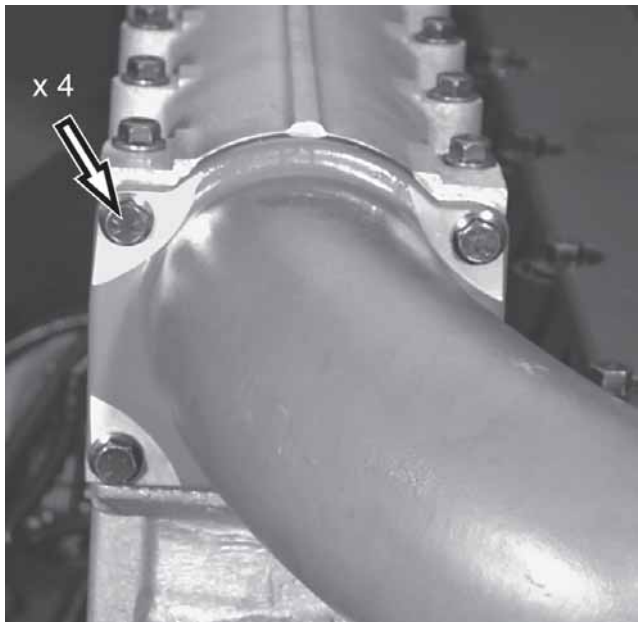
Turn off the main switch(es) and check that there is no power to the engine.

2 (TAD)



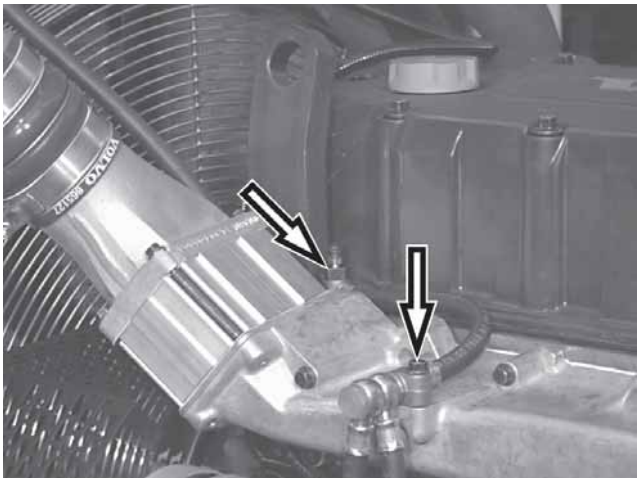
Release the clamps and remove the turbo delivery pipe.

2 (TWD)



Release the turbo delivery pipe from the charge air cooler.

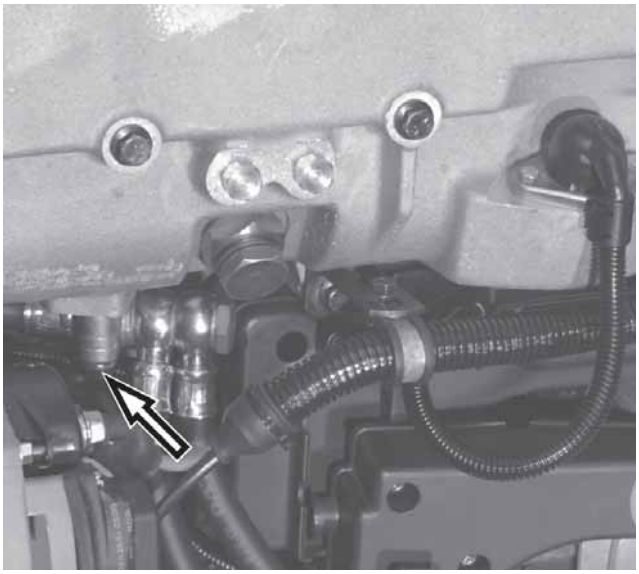
3 (TAD)



Remove the bypass valve from the intake manifold.

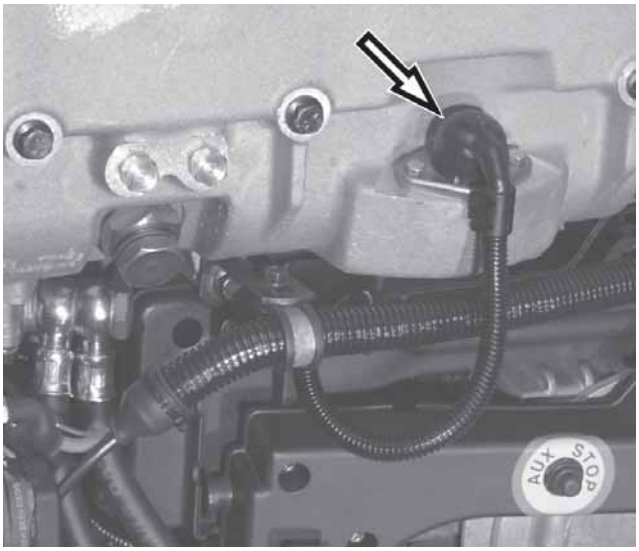
NOTE: If the fuel connections to the cylinder head must be removed, the fuel system must first be drained. See “Fuel system, draining”.

3 (TWD)



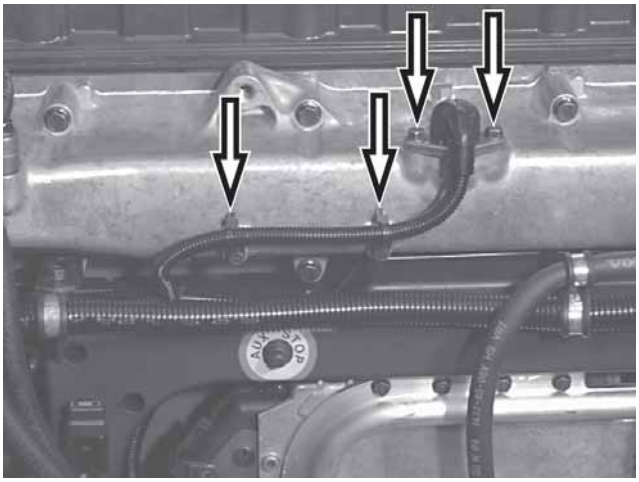
Remove the bypass valve from the intake manifold.

4 (TWD)



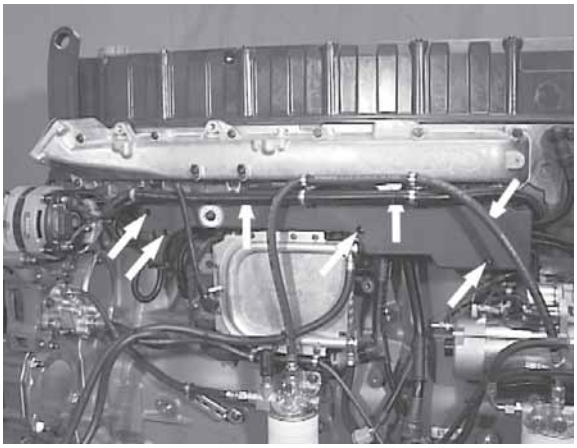
Remove the charge air temperature/boost pressure sensor.

4 (TAD)



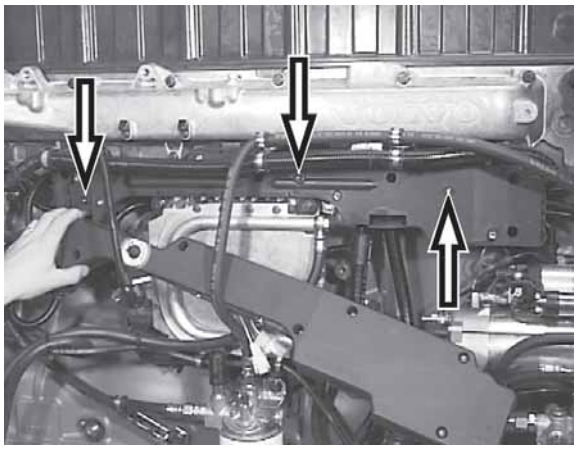
Cut the ties and remove the charge air temperature/ boost pressure sensor.

5



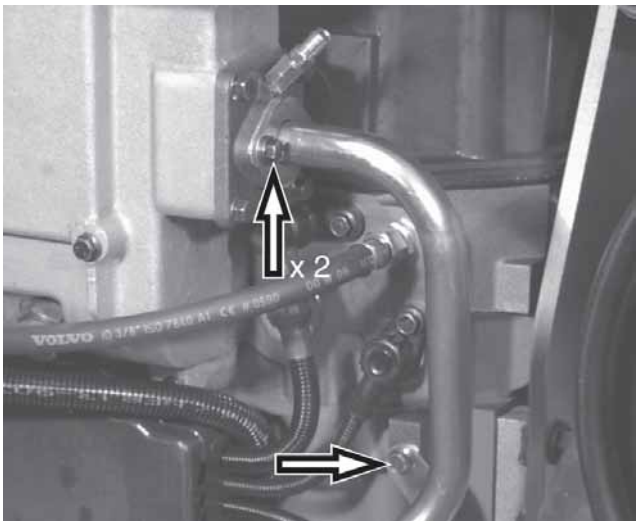
Remove the cover from the wiring box. (Torx bolts).

6



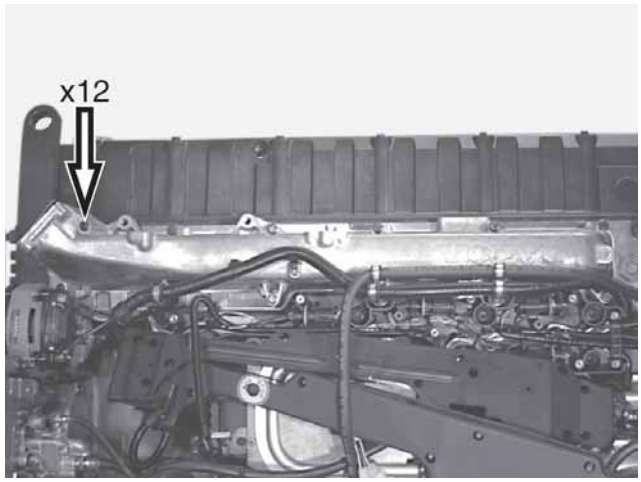
Remove the intermediate bracket (Torx bolts).

7 (TWD)



Remove the water pipes on both ends of the charge air cooler.

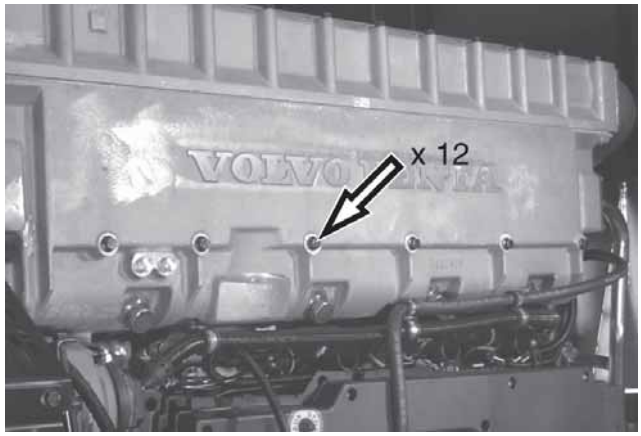
8 (TAD)



Remove intake manifold.

NOTE: The intake manifold may be stuck tight if the sealing compound has hardened.

8 (TWD)



Remove the intake manifold.

NOTE: The intake manifold/charge air cooler is heavy. If no lifting device is available, avoid injury and damage by having two persons ready to lift the intake manifold/charge air cooler.

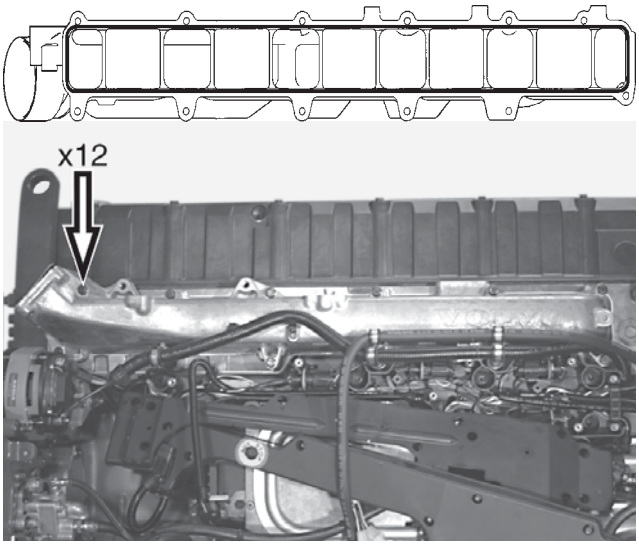
Installation

9

Carefully clean the contact surfaces on the intake manifold and cylinder head.

TAD: Scrape away the gasket with a wooden or plastic scraper.

10 (TAD)

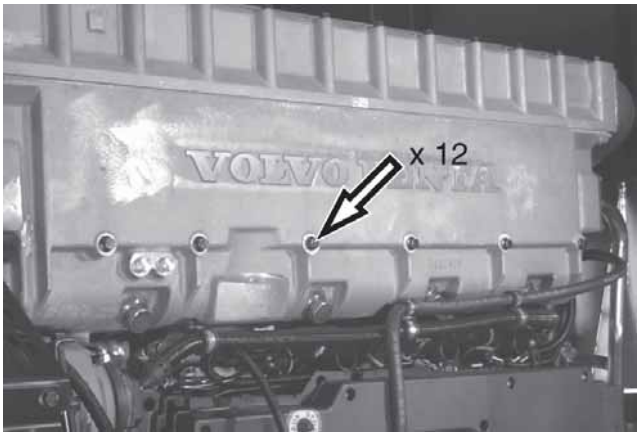


Apply a 2 mm (¾") wide bead of sealant item no. 1161231-4 on the intake manifold.

NOTE: The intake manifold must be installed and torqued within 20 minutes from applying the sealant.

NOTE: Sealant should be applied as shown in the picture above, 3 mm (1¼") from the inside edge of the intake manifold contact surface.

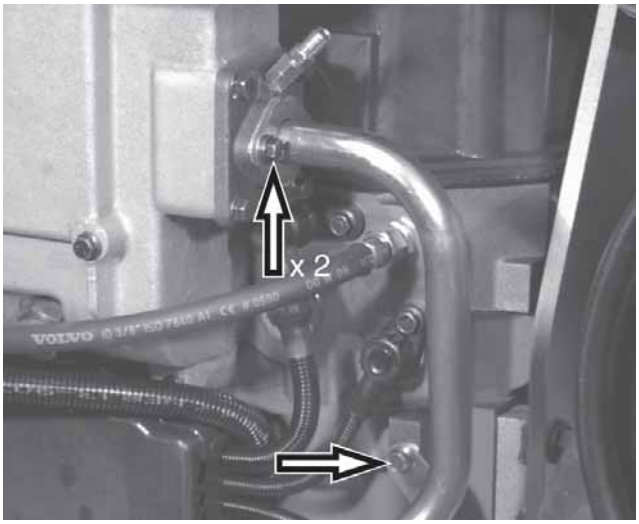
10 (TWD)



Reinstall the intake manifold/charge air cooler with a new gasket.

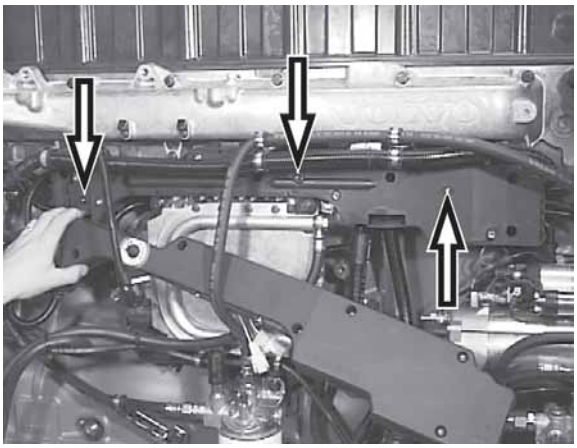
NOTE: The intake manifold/charge air cooler is heavy. If no lifting device is available, avoid injury and damage by having two persons ready to lift the intake manifold/charge air cooler.

11 (TWD)



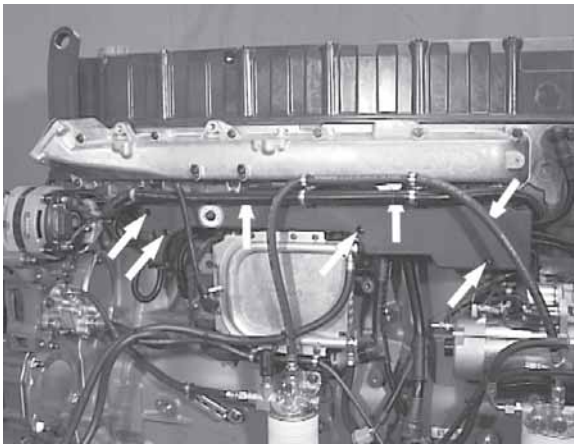
Reinstall the water pipes on both ends of the charge air cooler using new sealing rings.

12



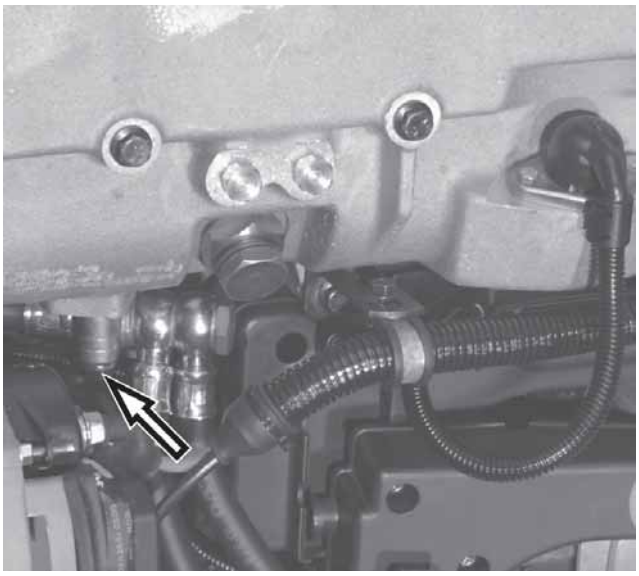
Reinstall the intermediate bracket (Torx bolts).

13



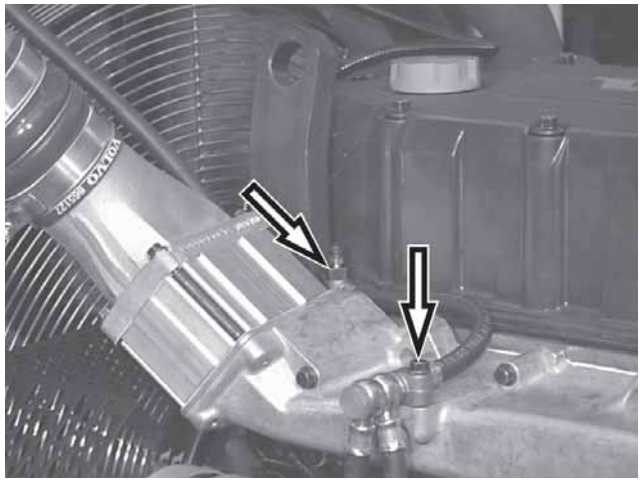
Replace the cover on the wiring box (Torx bolts).

14 (TWD)



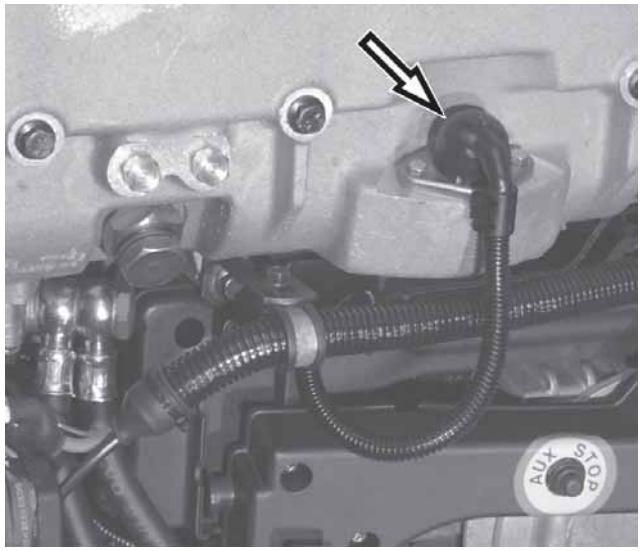
Reinstall the bypass valve on the intake manifold.

14 (TAD)



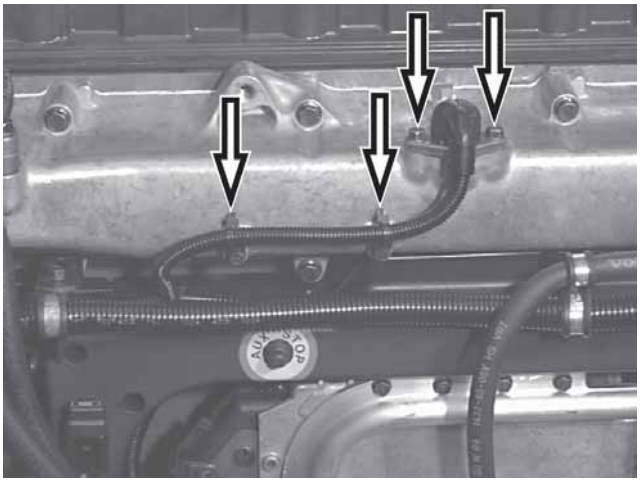
Reinstall the bypass valve on the intake manifold.

15 (TWD)



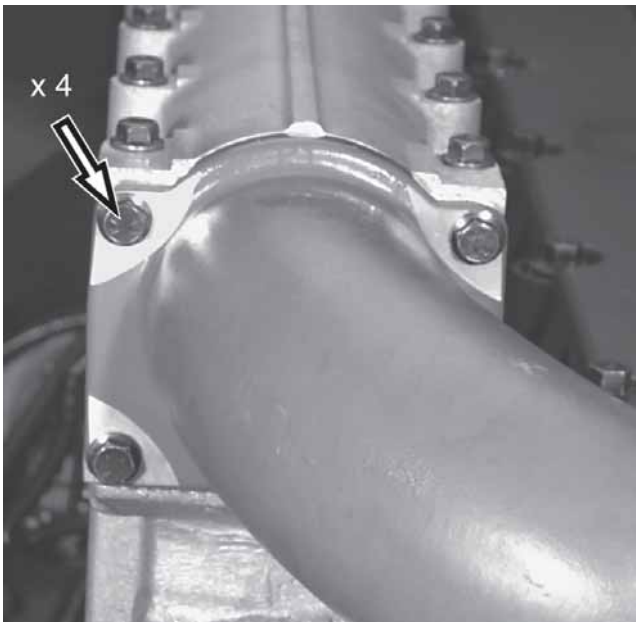
Reinstall the charge air temperature/boost pressure sensor on the intake manifold.

15 (TAD)



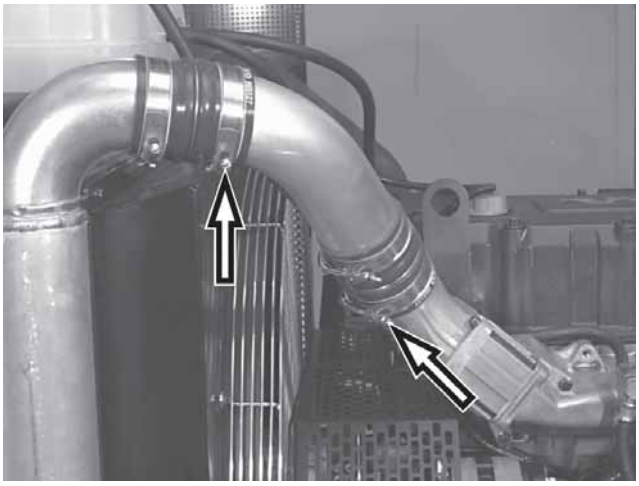
Reinstall the charge air temperature/boost pressure sensor on the intake manifold and attach the wiring with new ties.

16 (TWD)



Reinstall the turbo delivery pipe on the charge air cooler with a new gasket.

16 (TAD)



Reinstall the turbo delivery pipe.

17

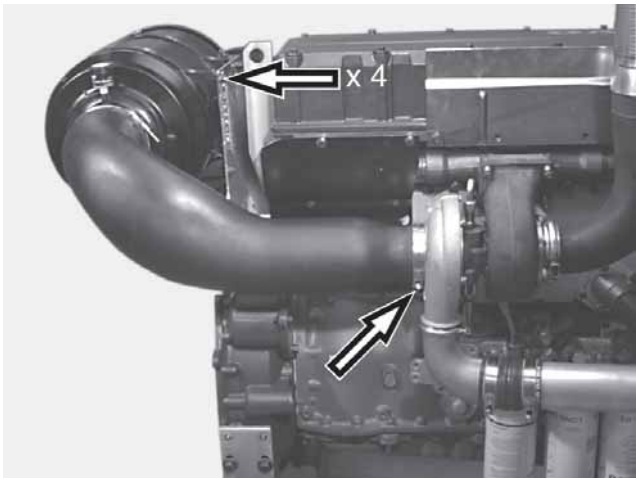
Start the engine and perform a functional test and leak check.

Exhaust manifold gasket, changing

1

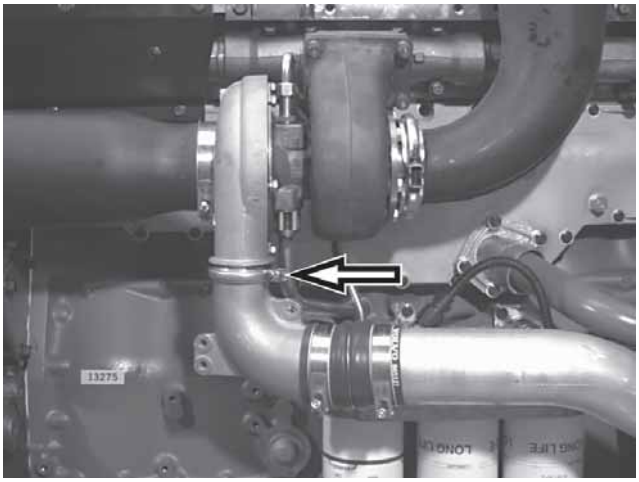
Turn off the main switch(es) and check that there is no power to the engine.

2



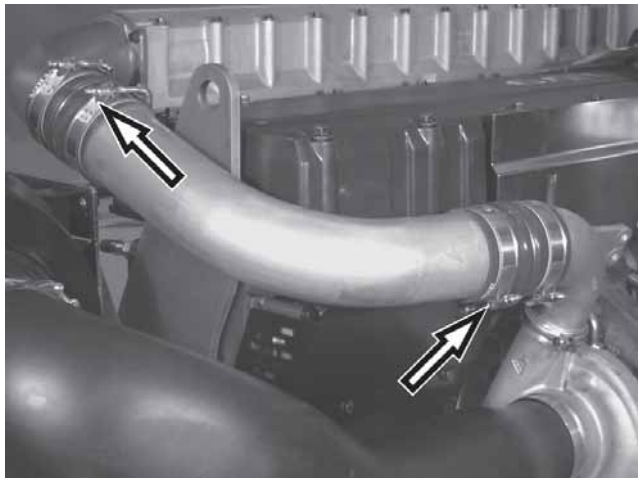
Release the clamp on the turbocharger and remove the air filter from the bracket. Remove the air filter and air duct.

3 (TAD)



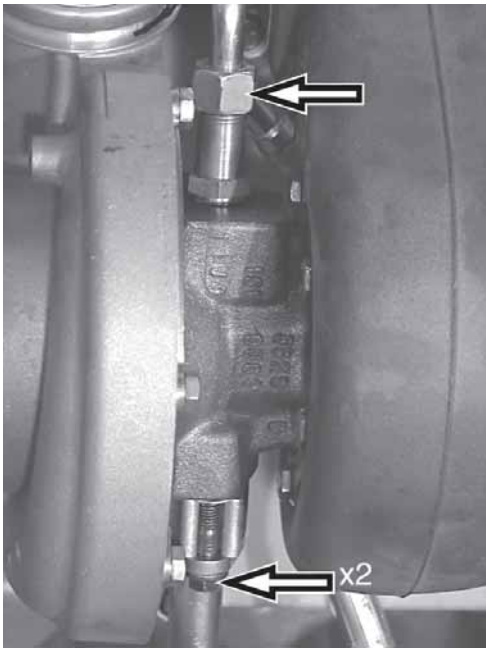
Remove the turbo delivery pipe at the turbo.

3 (TWD)



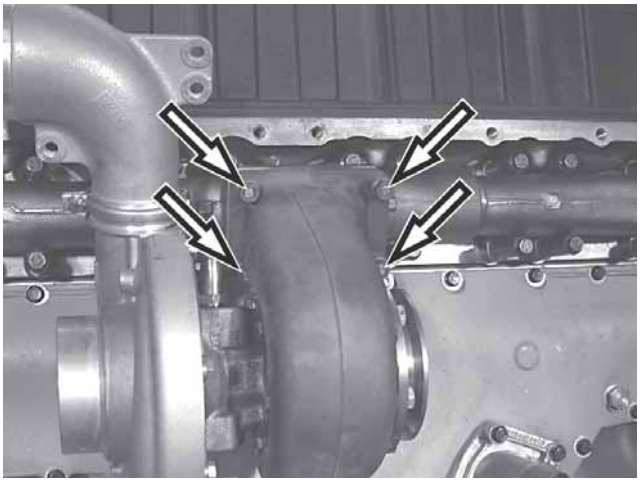
Remove turbo delivery pipe.

4



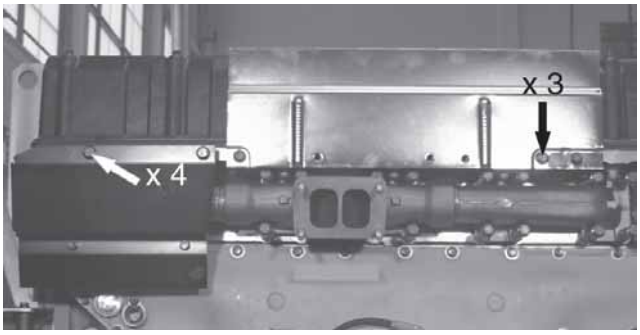
Remove the oil pipe from the turbocharger.

5



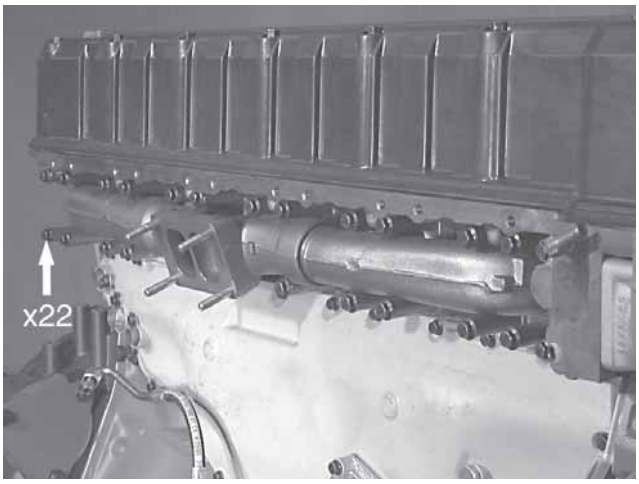
Remove the turbocharger.

6



Remove the rear protective plate and the front heat shield.

7



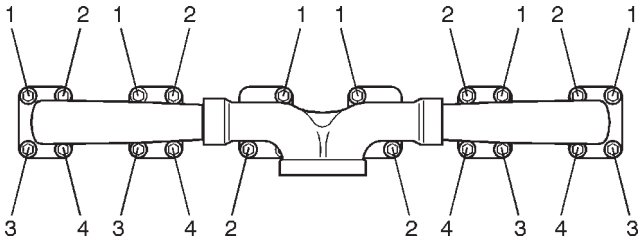
Remove the exhaust manifold.

Installation

9

Carefully clean the contact surfaces on the exhaust manifold and cylinder head.

10



Install the exhaust manifold using new gaskets and torque as shown below:

Step 1: Torque bolts (1) to 10 Nm (7 ft-lbf) (max)

Step 2: Torque bolts (2) to 10 Nm (7 ft-lbf) (max)

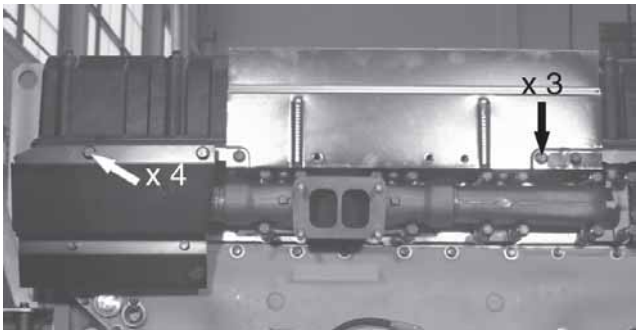
Step 3: Torque bolts (3) to 52 ± 4 Nm (38 ± 3 ft-lbf)

Step 4: Torque bolts (2) to 54 ± 4 Nm (38 ± 3 ft-lbf)

Step 5: Torque bolts (4) to 54 ± 4 Nm (38 ± 3 ft-lbf)

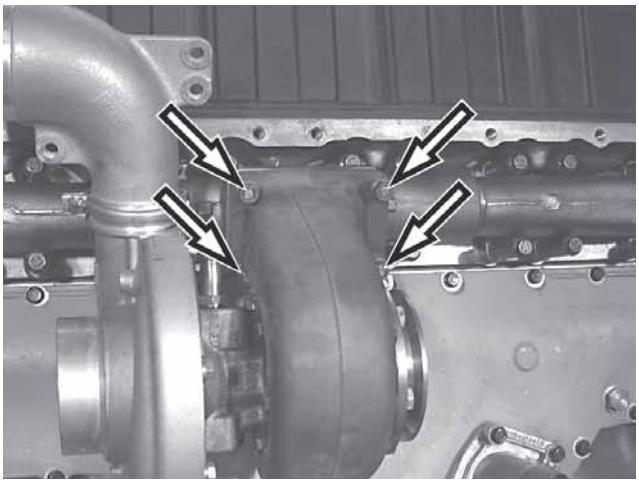
Step 6: Torque bolts (1) to 54 ± 4 Nm (38 ± 3 ft-lbf)

11



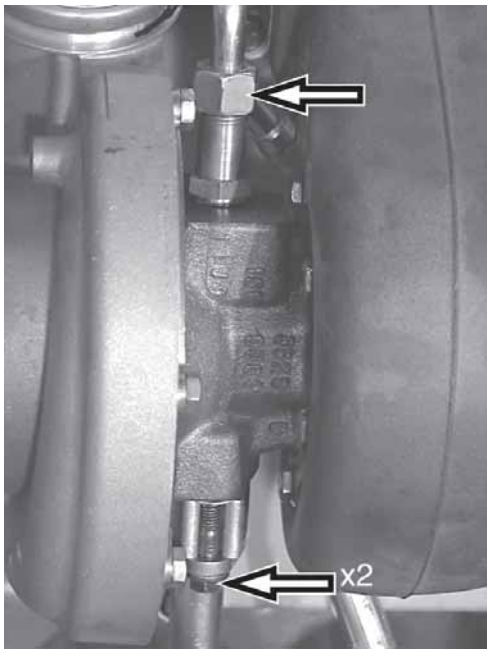
Replace the rear protective plate and the front heat shield.

12



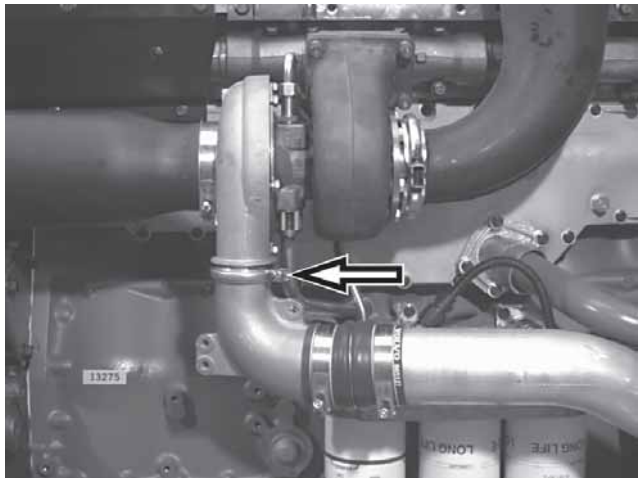
Install the turbocharger using a new gasket.

13



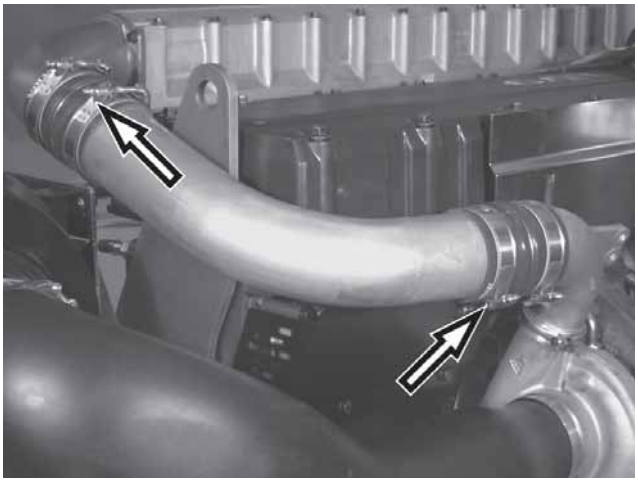
Reinstall the oil pipe with new seals.

14 (TAD)



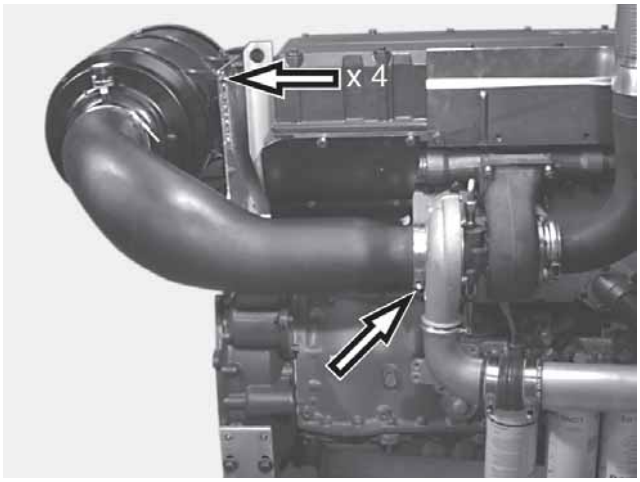
Reinstall the turbo delivery pipe on the turbo.

14 (TWD)



Reinstall the turbo delivery pipe.

15



Reinstall the air filter and air hose.

16

Check the oil level and if necessary add engine oil according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”

17

Start the engine and perform a functional test and leak check.

Turbocharger, changing

Always troubleshoot and repair any cause of damage to the turbo before installing a new unit.

The engine’s lubrication system and intake system must be maintained properly for the turbo to work well; the oil and the oil filter must be changed at the specified intervals, the correct type of oil must be used and the air filter must be maintained correctly. The first step in installing a new turbo should therefore be be to check the engine oil and change the filter if necessary, then run the engine for a few minutes before installing a new turbo.

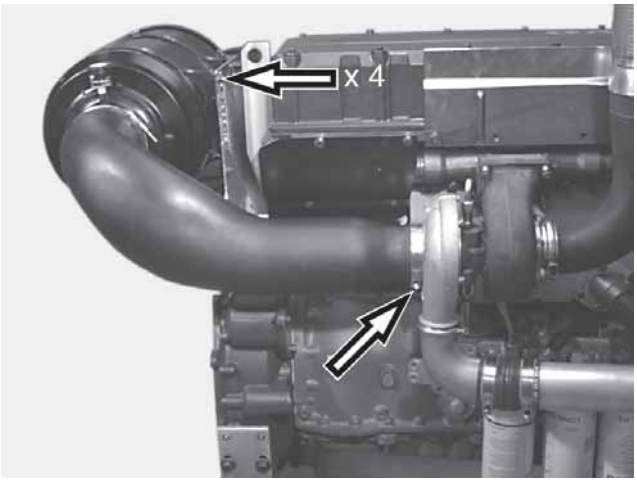
When changing the turbo, blow out any flakes of rust or soot from the exhaust manifold as these flakes can damage the turbine on the new unit.

It is also important to clean out the intake duct from the air filter. Fragments from a damaged compressor wheel, for example, can remain and cause immediate damage to the new turbo.

1

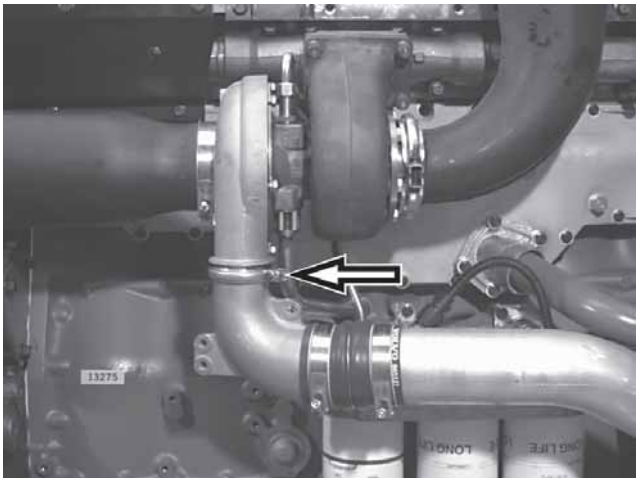
Open the main switch(es) and check that there is no power to the engine.

2



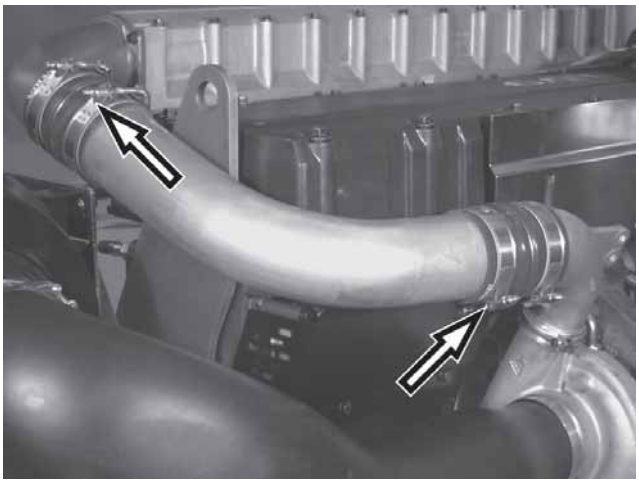
Release the clamp on the turbocharger and remove the air filter from the bracket. Remove the air filter and air duct.

3 (TAD)



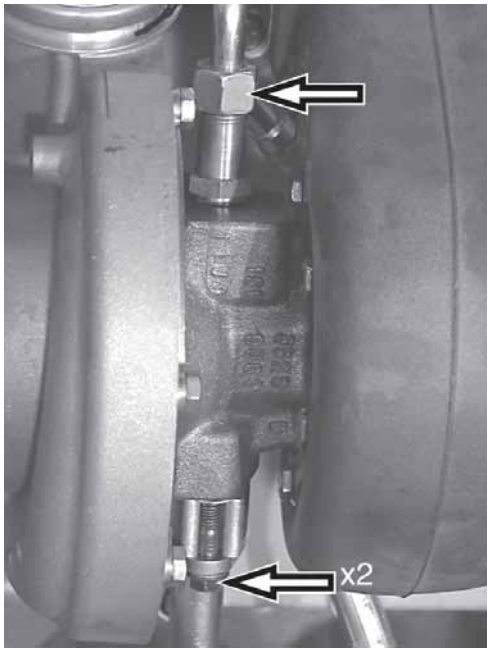
Remove the turbo delivery pipe from the turbo.

3 /TWD



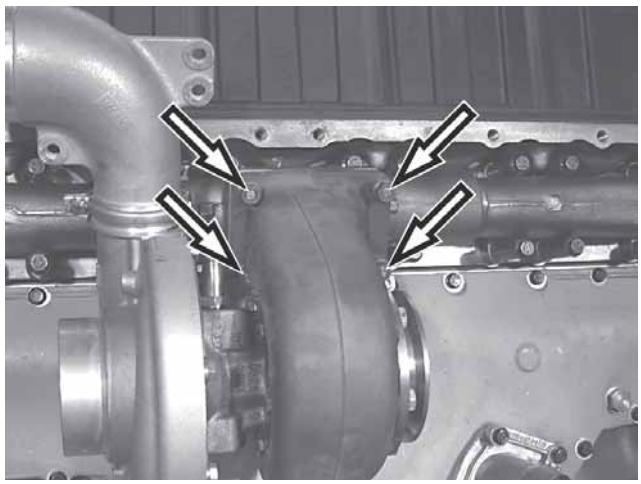
Remove the turbo delivery pipe.

4



Remove the oil pipe from the turbocharger.

5



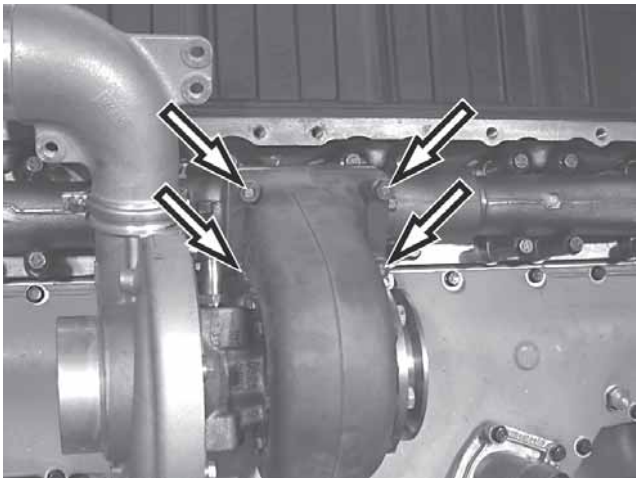
Remove the turbocharger.

Installation

6

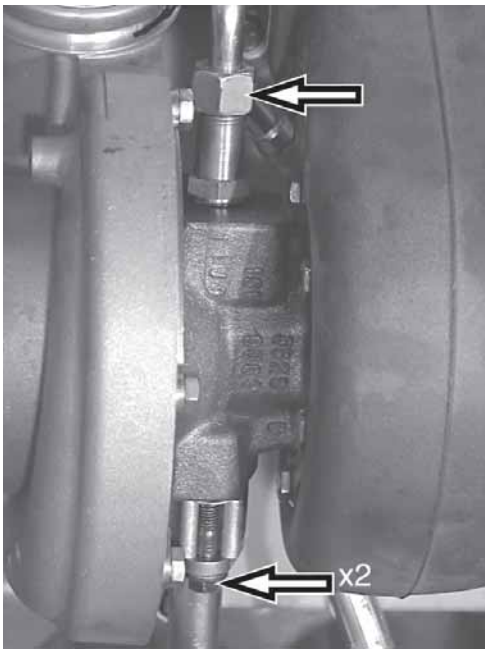
Clean the contact surfaces carefully.

7



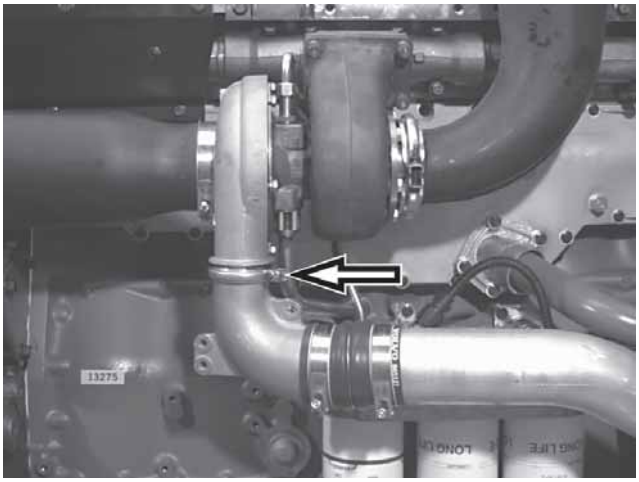
Install the turbocharger with a new gasket.

8



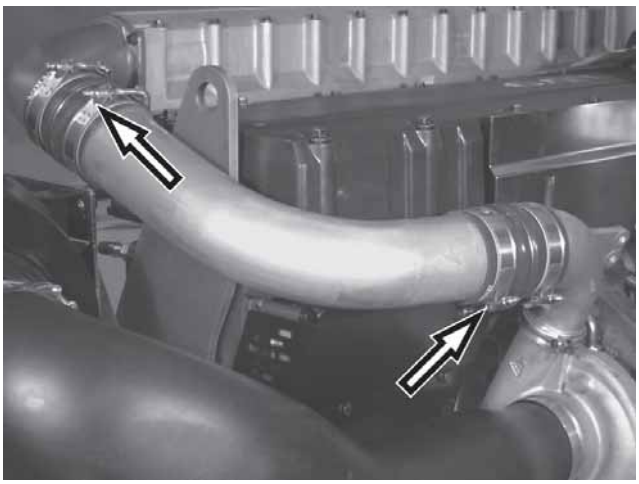
Reinstall the oil pipe with new seals.

9 (TAD)



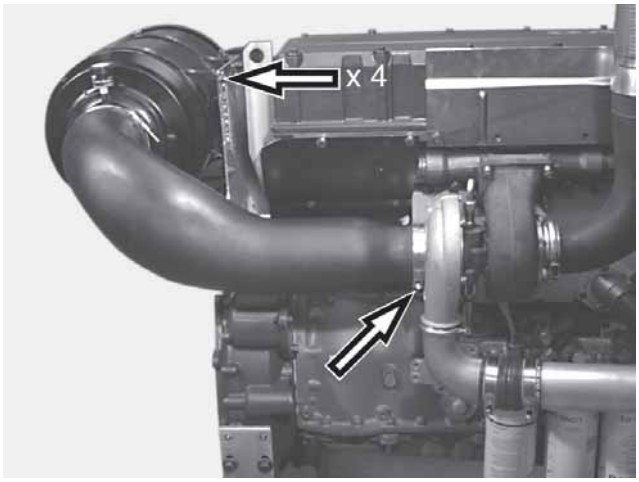
Reinstall the turbo delivery pipe on the turbo.

9 (TWD)



Reinstall the turbo delivery pipe.

10



Reinstall the air filter and air duct.

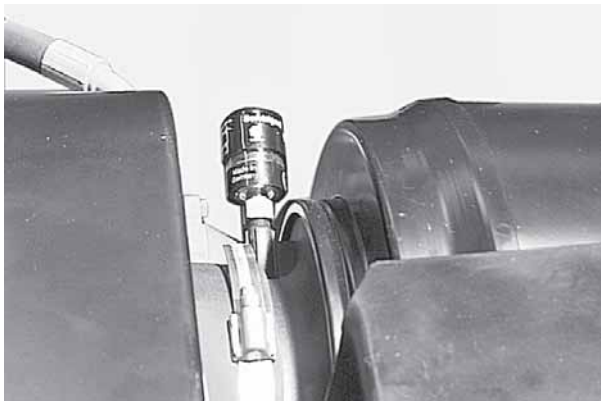
11

Check the oil level and if necessary add engine oil according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

12

Start the engine and perform a functional test and leak check.

Pressure drop indicator, checking



1

Remove the pressure drop indicator. Check the pressure drop indicator by applying a vacuum (reduced pressure) until the indicator shows red. Press the button on top of the pressure drop indicator to reset.

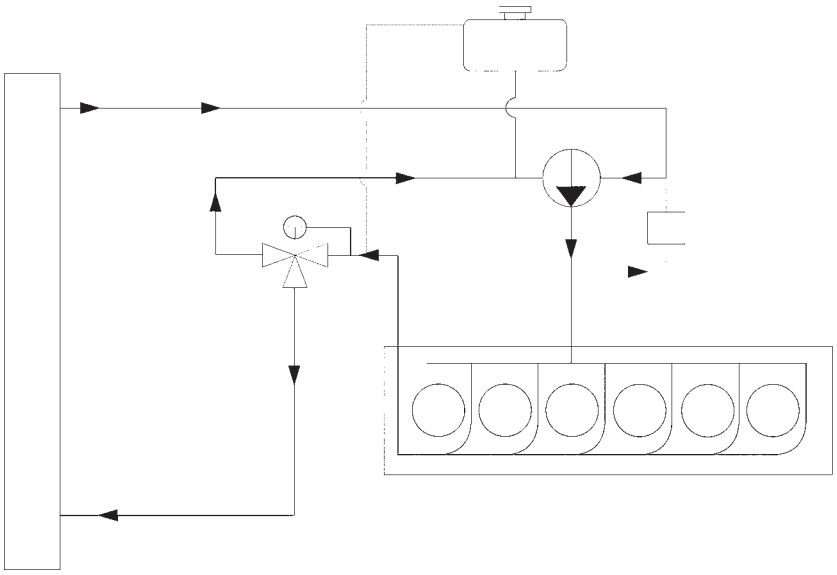
2

When the air filter is clogged, for example, and the pressure falls, the pressure drop indicator indicates this by showing red. If the pressure drop indicator is not working as described in step 1, it should be changed.

3

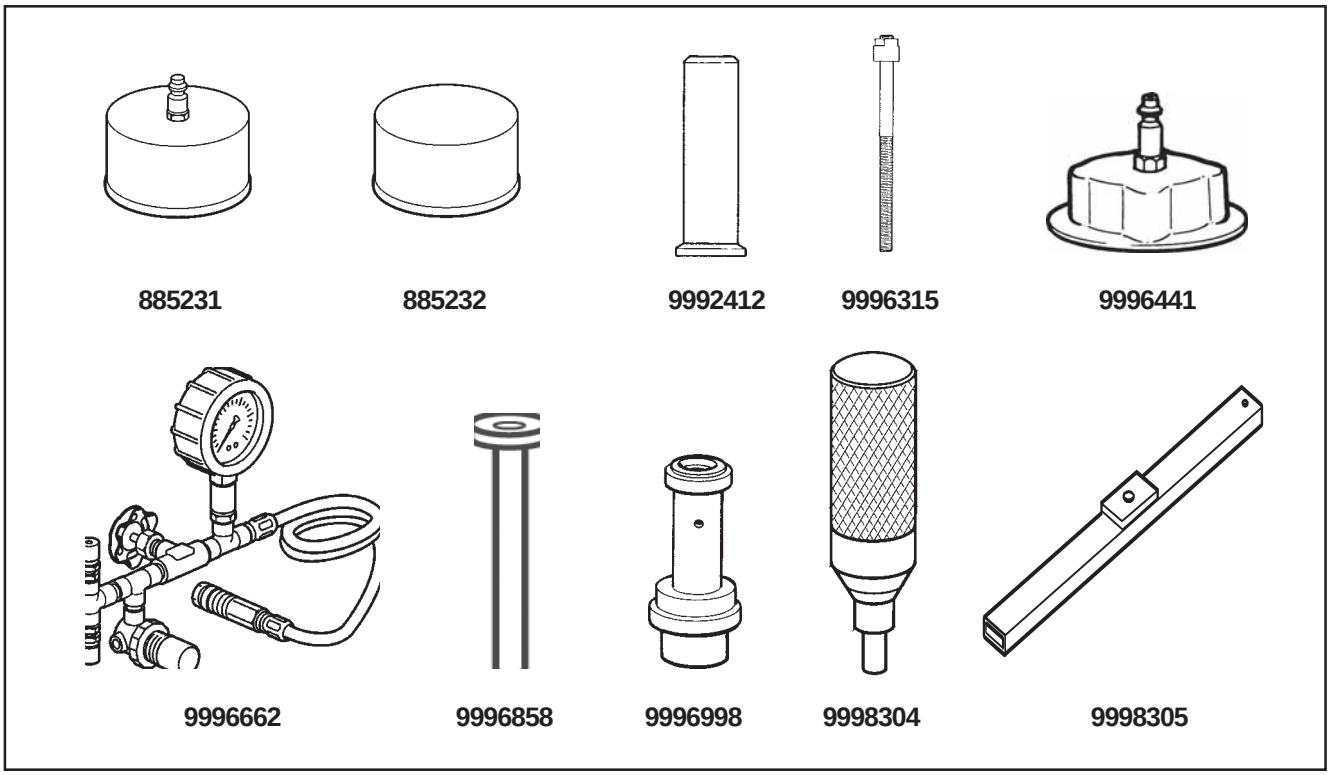
Reinstall the pressure drop indicator.

Group 26 Cooling System



Tools

Special tools

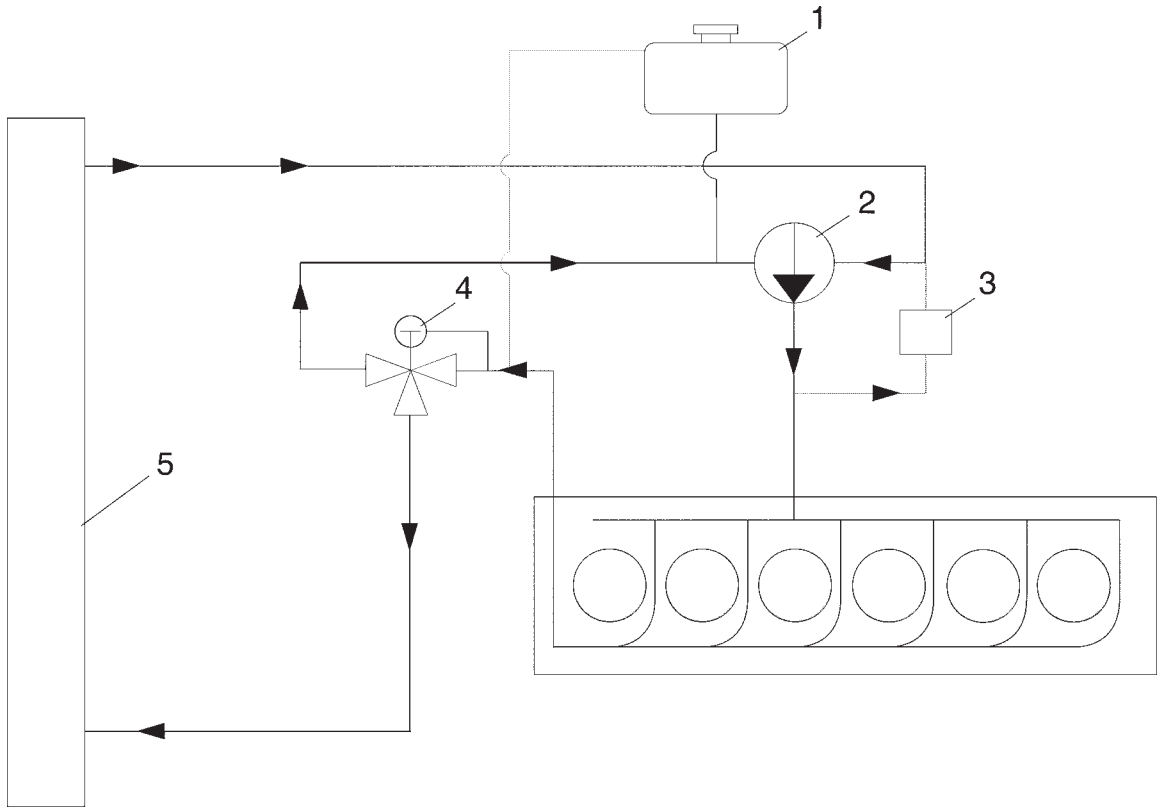


885231	Pressure plug with connection nipple	**9996858**	Gauge pin
885232	Pressure plug	**9996998**	Gauge pin
9992412	Gauge pin	**9998304**	Gauge
9996315	Gauge pin	**9998305**	Holder
9996441	Cap, leak testing		
9996662	Leak testing equipment		

Design and Operation

Cooling system (TAD)

The cooling system is a closed fresh-water system with a piston thermostat which controls the water temperature.



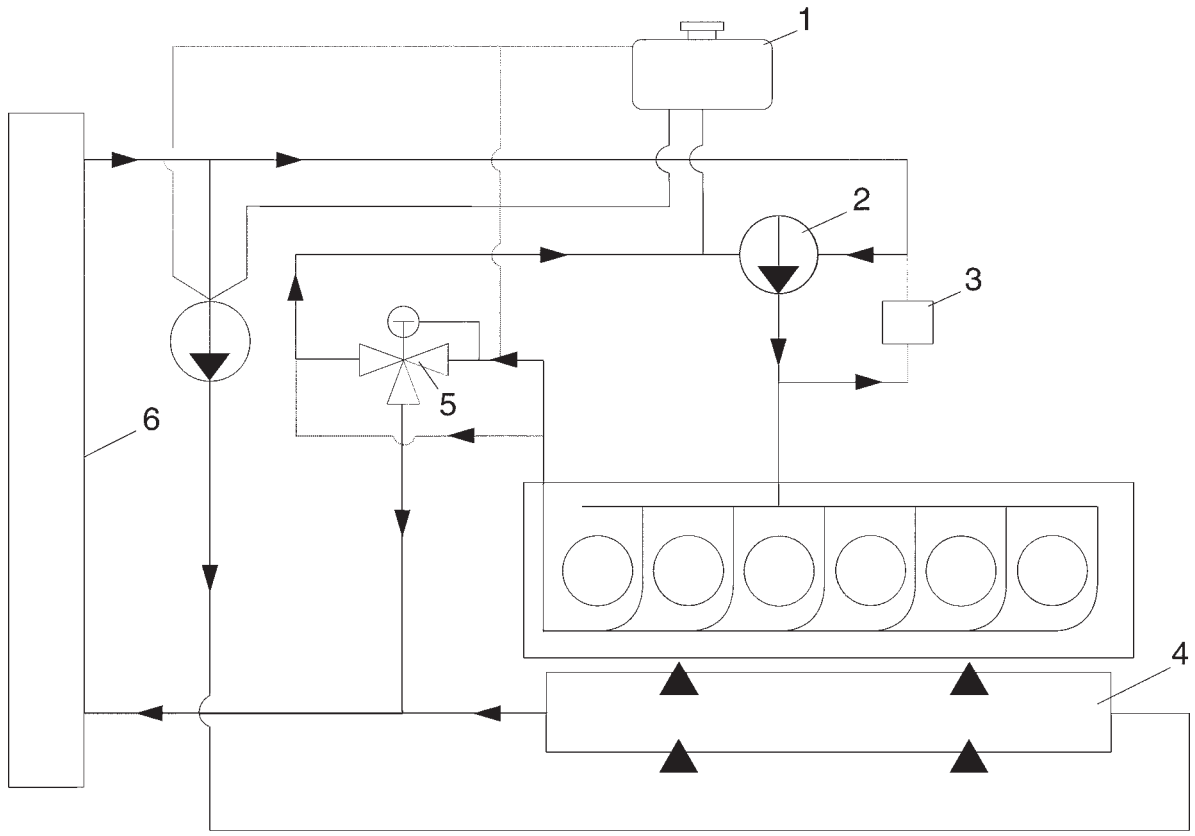
1 Expansion tank
2 Coolant pump
3 Coolant filter
4 Thermostat housing
5 Radiator

Cooling system (TWD)

The cooling system is a closed fresh-water system with a piston thermostat which controls the water temperature.

The TWD engine has a water-cooled charge air cooler that is integrated into the engine cooling system.

An extra coolant pump supplies the charge air cooler and is installed on the generator.



1 Expansion tank
2 Coolant pump
3 Coolant filter
4 Charge air cooler (water-cooled)
5 Thermostat housing
6 Radiator

Charge air cooler

On TAD engines, the charge air cooler is located with the radiator and is air cooled. On TWD engines, the charge air cooler is located at the intake manifold on the left-hand side of the engine and is water cooled.

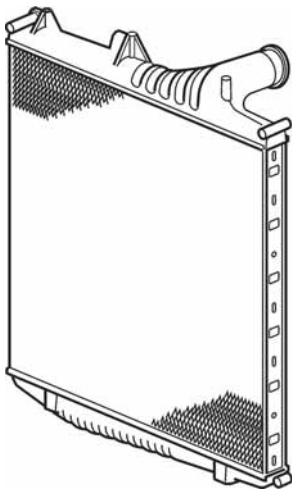
The purpose of the charge air cooler is to cool the intake air, which means that the specific volume of the air is reduced so that larger quantities of air can be forced into the combustion chamber. This means better combustion of fuel and hence better fuel efficiency.

Cooling the engine charge air gives a power increase of about 10%, increased torque and reduced fuel consumption.

A diesel engine with turbocharger and charge air cooler has the best efficiency of all internal combustion engines.

Charge air cooler TAD1240GE, TAD1241GE, TAD1242GE

Charge air cooler TWD1240VE



Charge air cooler TAD1241VE

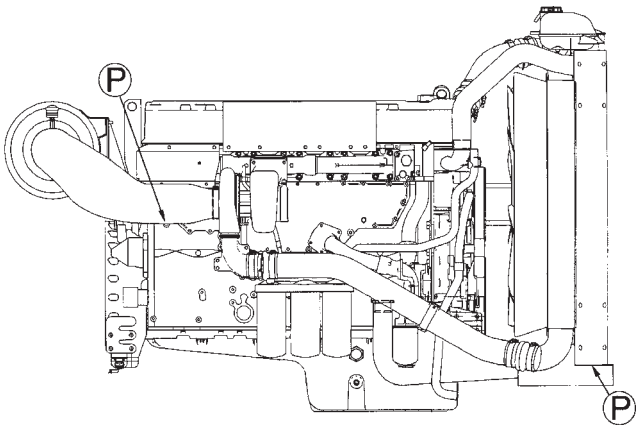
Repair instructions

Cooling system, draining

⚠ **WARNING!** Open the filler cap very carefully when the engine is hot. Steam or hot coolant can spray out.

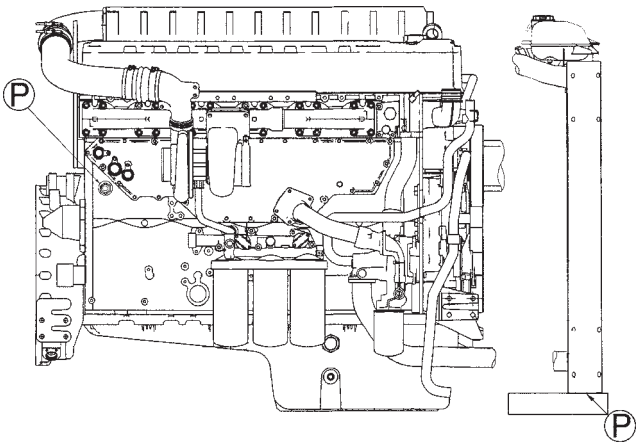
NOTE: Before draining the cooling system, remove the expansion tank cap.

TAD



P = fresh water drainage valve/plug

TWD



P = fresh water drainage valve/plug

1

Open all drain locations. Drain the coolant from the radiator using drain hoses. The drain nipple is located under the radiator.

2

Check that all coolant runs out. There may be deposits inside the valve/plug which must be cleaned out. Otherwise there is a risk that water can be trapped and cause serious damage.

Check whether the system has any other valves or plugs on the lowest points of the coolant lines.

3

Close the valves and reinstall plugs.

Cooling system, filling

1

⚠ **WARNING!** Open the filler cap very carefully when the engine is hot. Steam or hot coolant can spray out.

NOTE: Only use Volvo Penta recommended coolant and mixtures.

2

NOTE: Fill the system only with the engine shut down.

Mix the correct volume of coolant in advance to be sure that the system is filled. Fill slowly to avoid the formation of air locks in the system. The air must be allowed to flow out through the filler opening and vent valves.

3

When filling an empty system or if the coolant level has for some reason fallen so low that it is not visible through the filler opening, open the vent valves on the turbocharger and the valves on the front of the heat exchanger during filling.

4

NOTE: The engine must not be started until the system has been bled and completely filled. If a space heater is connected to the engine cooling system, the heater control valve should be opened and the system vented during filling.

5

Fill with coolant to approx. 50 mm (2") below the sealing surface of the filler cap.

6

Start the engine and let it run for about 1 hour.

Switch off the engine, check the coolant level and add coolant if required.

Coolant pump, changing

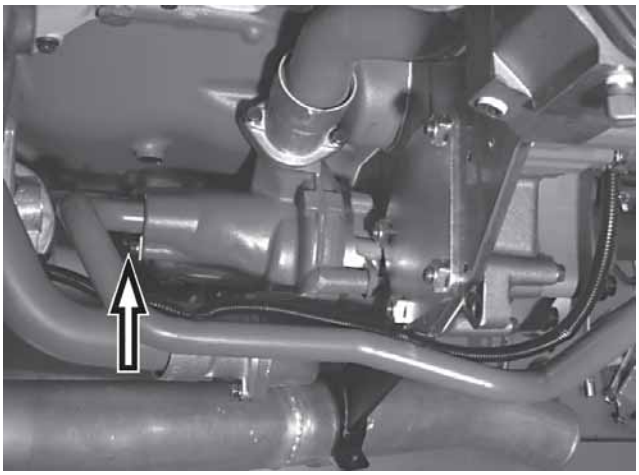
1

Open the main switch(es) and check that there is no power to the engine.

2

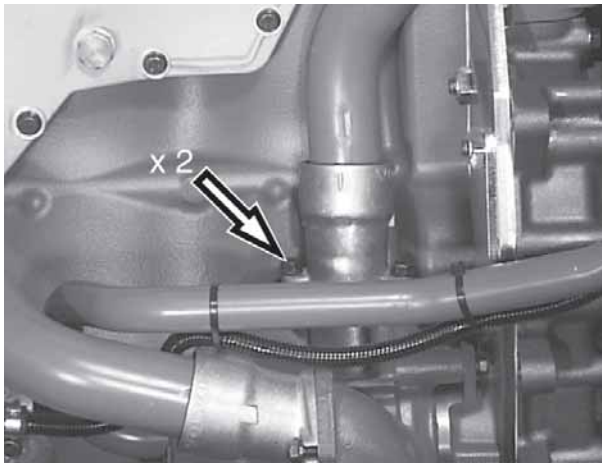
Drain the cooling system, see “Cooling system, draining”.

3



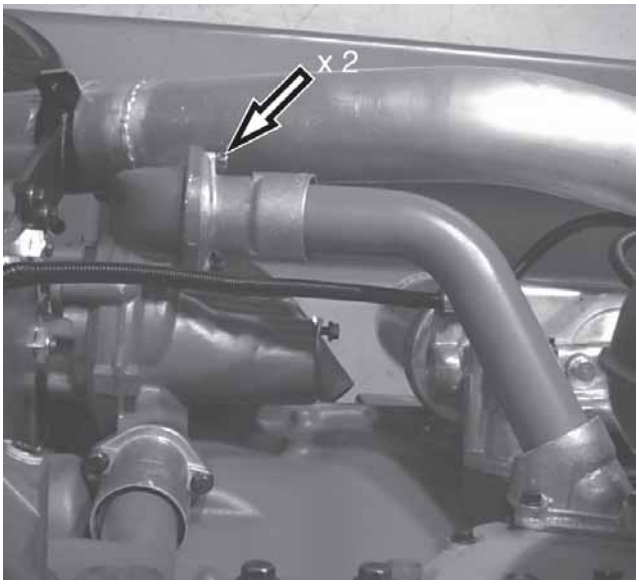
Remove the water pipe from the coolant pump and from the radiator hose connection.

4



Remove the water pipe between the coolant pump and thermostat housing.

5



Remove the water pipe between the oil cooler element and the coolant pump.

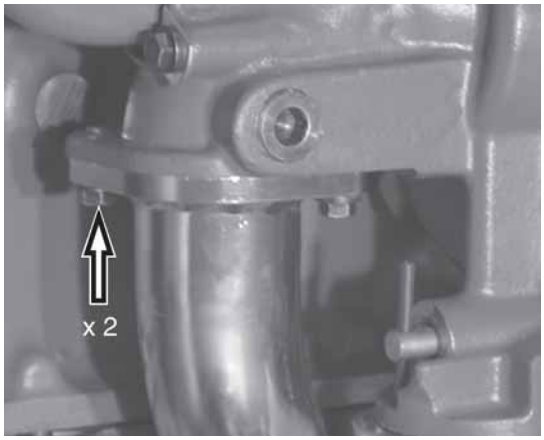
6

Remove the coolant filter with a suitable wrench.

7 (TAD)

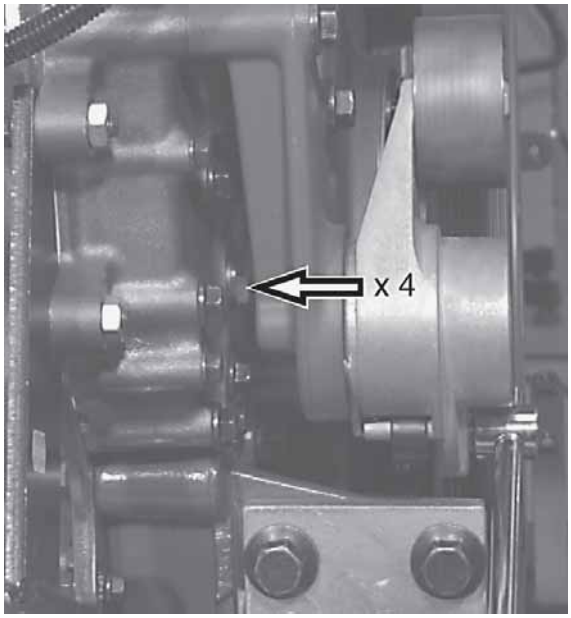
Remove the radiator hose at the coolant pump.

7 (TWD)



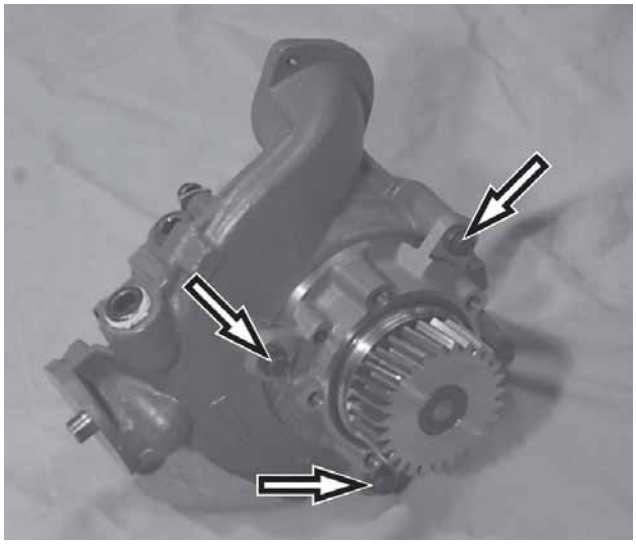
Remove the water pipe from the coolant pump.

8



Remove the coolant pump.

9



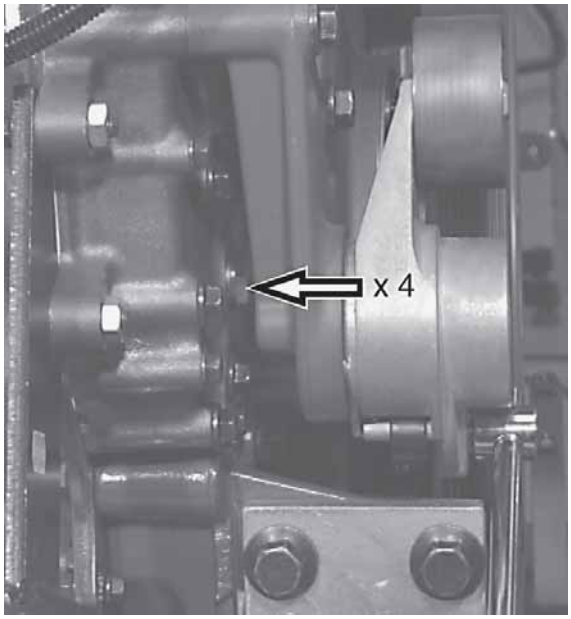
Remove the gear unit from the coolant pump.

10

Install the new gear unit in the coolant pump with new sealing rings.

NOTE: Lubricate the sealing rings to make it easier to fit the gear unit in the coolant pump.

11



Install the coolant pump.

NOTE: Be sure that the coolant pump is correctly seated and that all bolts are screwed in before being tightened.

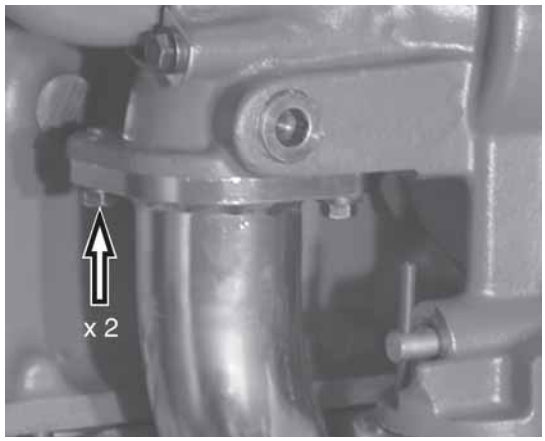
12

Lubricate the sealing rings with a thin layer of engine oil and install the new coolant filter. See installation instructions on the filter canister.

13 (TAD)

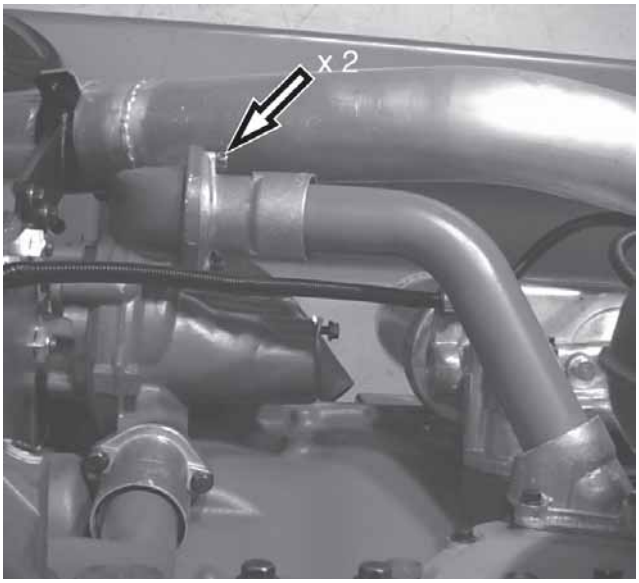
Reinstall the radiator hose between the coolant pump and the radiator.

13 (TWD)



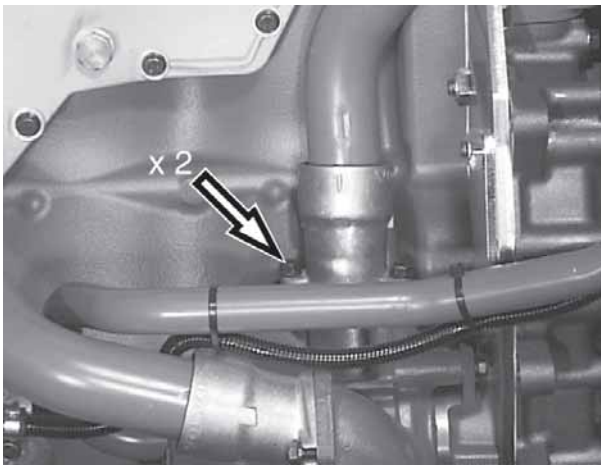
Reinstall the water pipe to the coolant pump using a new gasket.

15



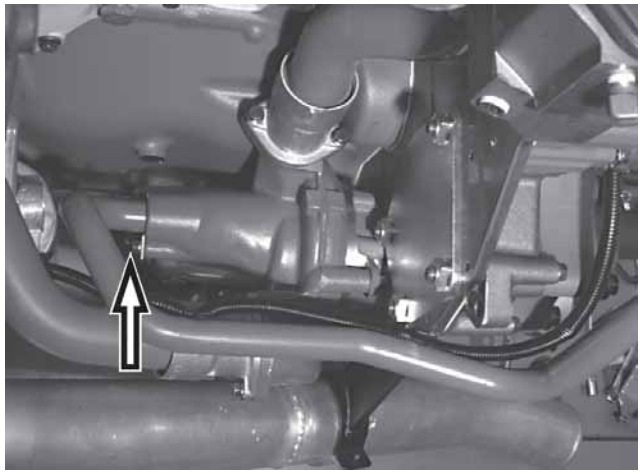
Reinstall the water pipe between the oil cooler element and the coolant pump. Use new gaskets.

16



Reinstall the water pipe between the oil cooler element and thermostat housing. Use new gaskets.

17



Reinstall the water pipe to the coolant pump and to the radiator connection.

18

Add coolant according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

19

Start the engine and check for leaks.

Coolant filter, changing

NOTE: Turn the valve at the coolant pump 90 degrees before removing the coolant filter. Do not forget to turn the valve back after the new coolant filter has been installed.

See “Coolant pump, changing” steps **6** and **12**.

Piston thermostat, changing

1

Drain the cooling system, see “Cooling system, draining”.

2

Remove the thermostat housing and take out the thermostat.

NOTE: Two bolts must be removed from the exhaust manifold in order to be able to remove the thermostat housing.

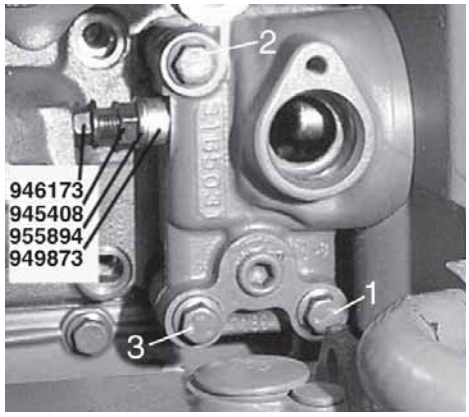
3

Clean all contact surfaces.

4

Install the new piston thermostat with a new sealing ring and hand-tighten the bolts.

5



Install a bolt (M8 x 20) with nut, washer and spacer between the flange of the exhaust manifold and the finished surface of the thermostat housing. Tighten the nut so that the spacer braces the thermostat housing against the gasket for the piston thermostat. Then tighten the thermostat housing bolts in the order shown in the picture. Remove the brace bolt.

6

Reinstall the two bolts on the exhaust manifold.

7

Add coolant according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

8

Start the engine and perform functional and leakage checks.

Piston thermostat, functional check

1

Drain the cooling system, see “Cooling system, draining.”

2

Remove the piston thermostat, see “Piston thermostat, changing.”

3

Closed thermostat

Open thermostat

Place the piston thermostat in a large pan of water and heat it to the temperature at which it should open: TAD 1240-42GE, TAD1241-42VE at 82° C (187° F) and TWD 1240VE at 75° C (165° F).

4

If the piston thermostat does not open at the proper temperature, replace it with a new one.

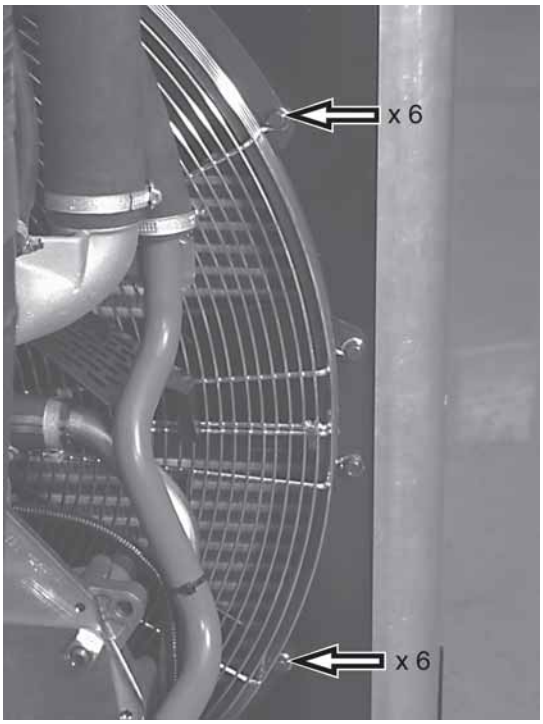
Drive belts, changing

Special tools: 9998304, 9998305

1

Open the main switch(es) and check that there is no power to the engine.

2

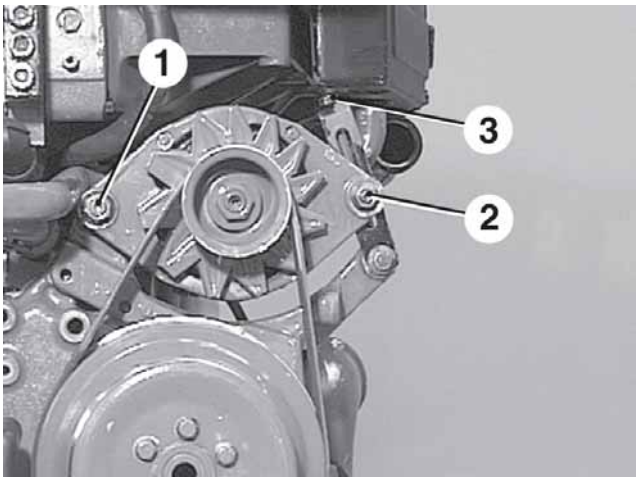


Remove the protective grille around the cooling fan.

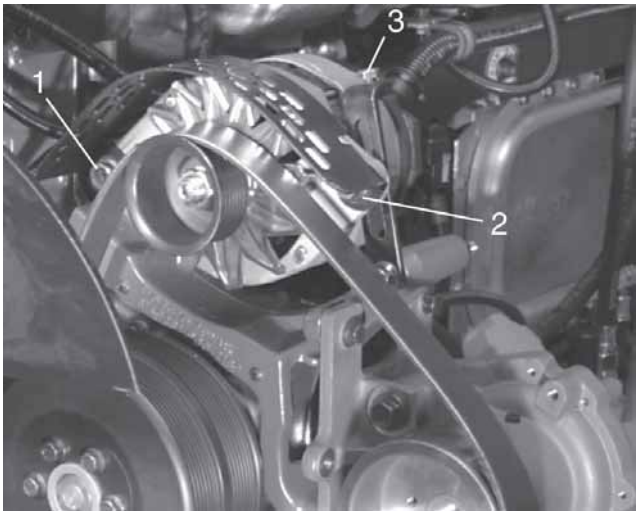
3

Remove the protective plates around the drive belts.

4 (TAD)



4 (TWD)



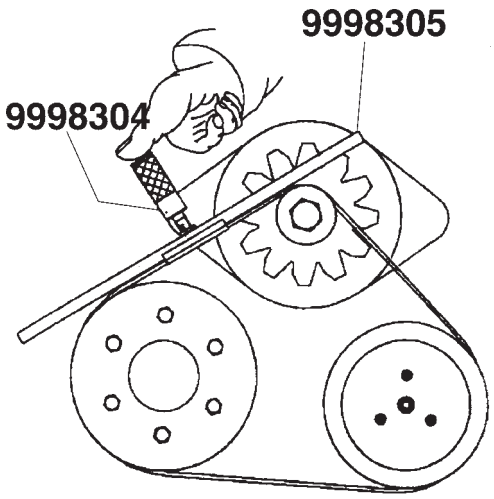
Loosen the inner mounting bolt (1) a few turns.

Loosen the locking bolt (2) so that the tensioning bolt (3) can operate freely. Screw down the tensioning bolt and remove the drive belt.

5

Install the new drive belt and tension the drive belt with the tensioning screw (3) so that the slack is about 5 mm (0.2").

6 Checking belt slack



Place holder 9998305 with the hole halfway between the pulleys where the drive belt is longest.

7

Push down the O-ring on the gauge 9998304 so that it lies below the graduated scale.

8

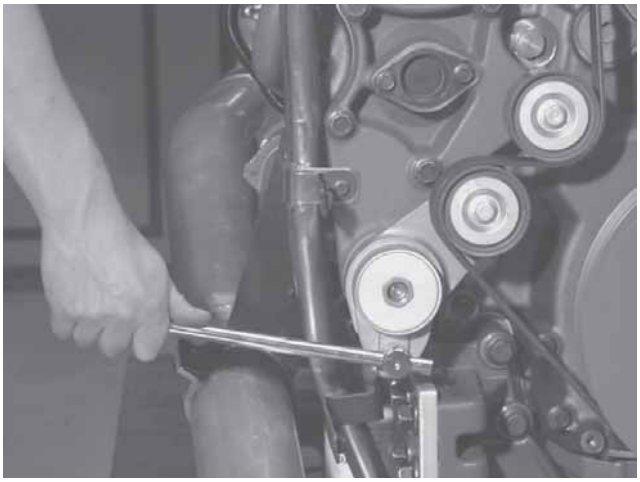
Keeping the holder in position, insert the gauge into the hole and push it in so that the end of the pin is flush with the upper part of the gauge (push with thumb or finger).

Remove the gauge carefully and read it.

The slack should be 3 mm (0.1") for a new belt, 3-4 mm (0.10-0.15") for an old belt.

NOTE: Tighten the tensioner before making the measurement because the belt will become tighter when the tensioner is snugged up.

9

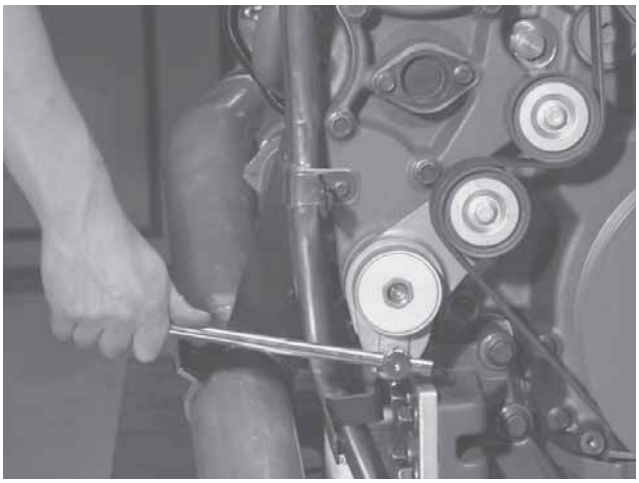


Fit a 1/2" socket wrench handle in the belt tensioner. Pull up on the handle and remove the drive belt.

10

Check that the belt pulleys are clean and undamaged.

11



Pull up on the 1/2" wrench handle and install the new drive belt.

12

Reinstall the protective plates around the drive belts.

13

Reinstall the protective grille and outer fan shrouds around the fan.

14

Start the engine and perform a functional check.

Cooling system, cleaning

Part no.: 1141658-3

1

Drain the cooling system, see “Cooling system, draining”.

2

NOTE: If the cooling system is cleaned regularly by draining and refilling with a rust-protection fluid, less cleaning additive or simply flushing with pure water may be sufficient.

3

Flush the cooling system with fresh water.

4

Fill the cooling system with radiator cleaner, item no. 1141658-3 (see instructions on package).

Then run the engine up to normal working temperature and allow it to run for at least another 2 hours.

NOTE: Alternatively, fill the system with 15–20% concentrated coolant and drain it out after 1–2 days’ operation.

5

Drain the cooling system and then flush it out with a mixture of neutralizer, part no. 1141658-3 (see instructions on package).

6

If any contamination remains, repeat the cleaning until the system is free from contamination.

7

When the cooling system is completely free from contamination, fill with fresh coolant. In areas where Volvo Penta concentrated coolant is not available, use water with a corrosion protection additive.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

Charge air cooler, changing (TAD)

1

Open the main switch(es) and check that there is no power to the engine.

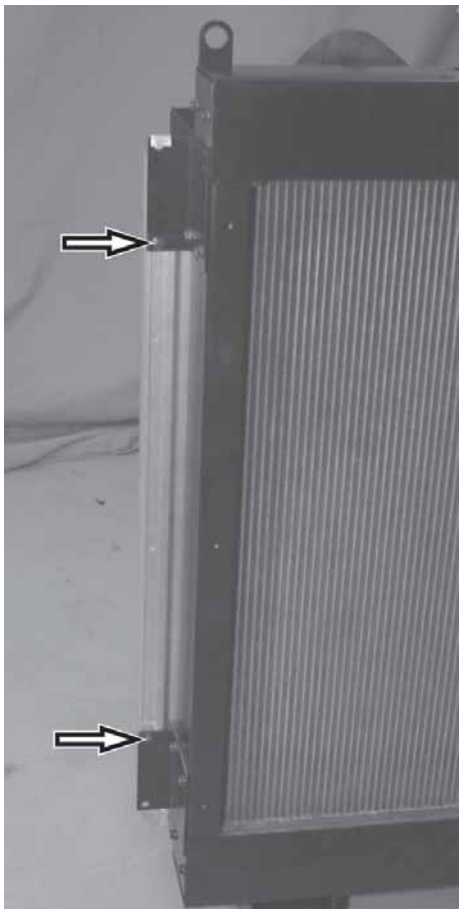
2

Drain the cooling system, see “Cooling system, draining ”.

3

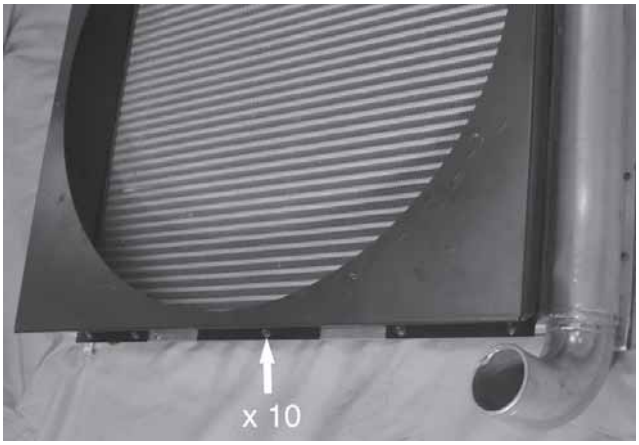
Remove the radiator assembly, see “Radiator, changing”.

4



Release the charge air cooler from the left and right sides of the radiator assembly.

5



Remove the fan cowling (10 bolts) from the charge air cooler.

6

Install the fan cowling (10 bolts) on the new charge air cooler.

7

Install the charge air cooler on the radiator.

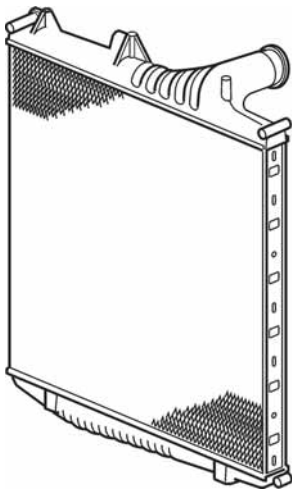
8

Install the radiator, see “Radiator, changing”.

9

Add coolant according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.



Charge air cooler TAD1241VE

Charge air cooler, changing (TWD)

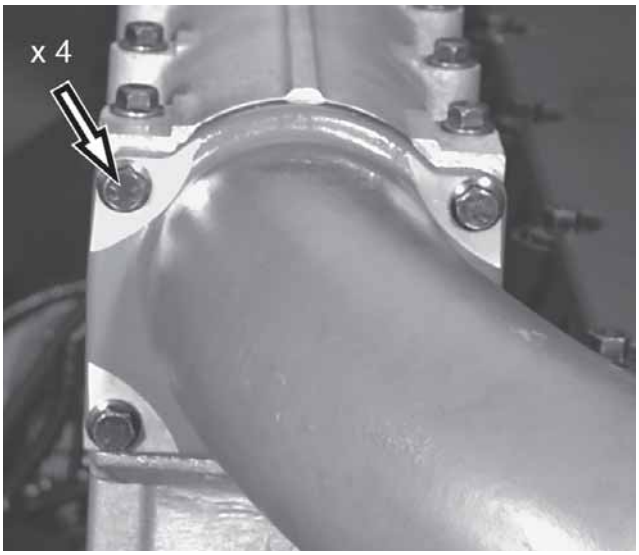
1

Open the main switch(es) and check that there is no power to the engine.

2

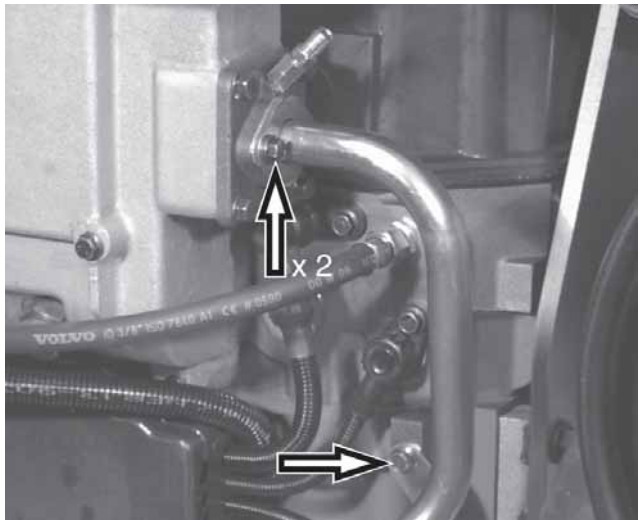
Drain the cooling system, see “Cooling system, draining ”.

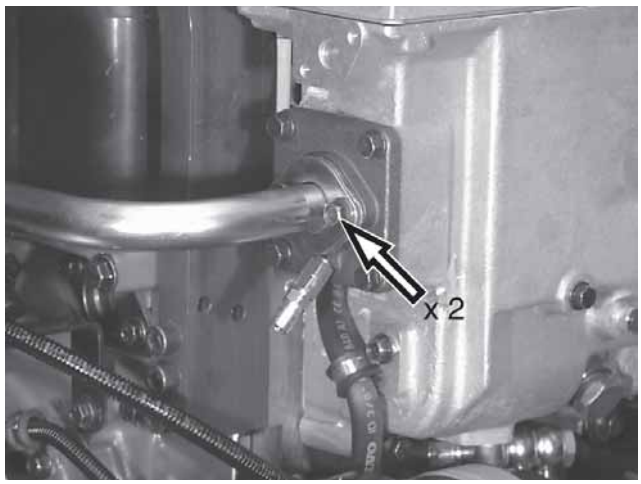
3



Remove the charge air pipe.

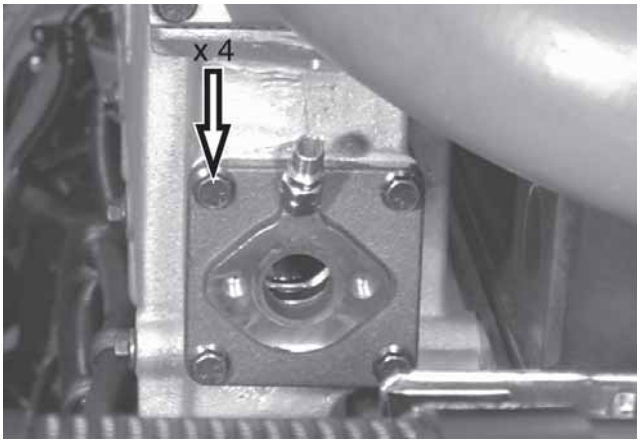
4





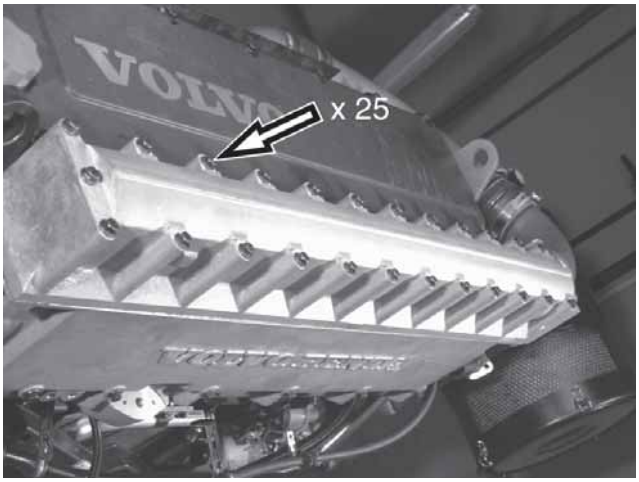
Remove the water pipes on the ends of the charge air cooler.

5



Remove the water pipe connectors on the ends of the charge air cooler.

6



Remove the cover from the charge air cooler.

7

Lift out the charge air cooler element.

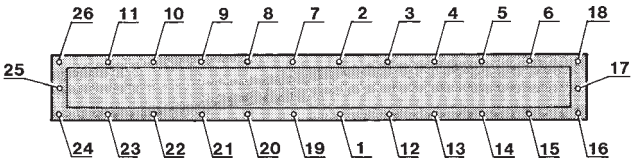
NOTE: The charge air cooler element is heavy. If no lifting device is available, avoid injury and damage by having two persons ready to lift the charge air cooler element.

8

Carefully clean the contact surfaces. Install a new gasket on the charge air cooler and install the new charge air cooler element.

NOTE: The charge air cooler element is heavy. If no lifting device is available, avoid injury and damage by having two persons ready to lift the charge air cooler element.

9



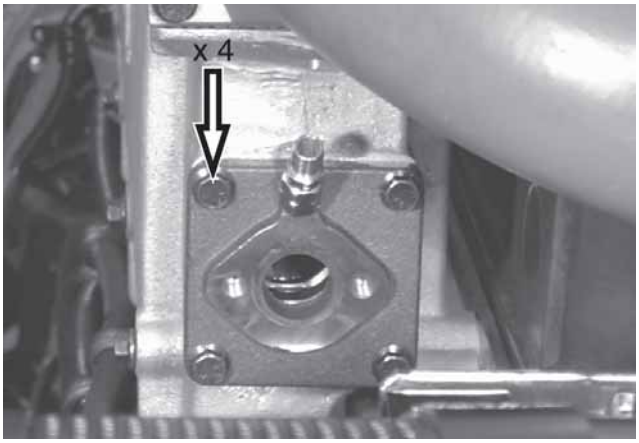
Reinstall the cover on the charge air cooler. Use a new gasket.

Torque the bolts in two steps as described below:

Step 1. Insert all bolts and screw then down into contact with the surface.

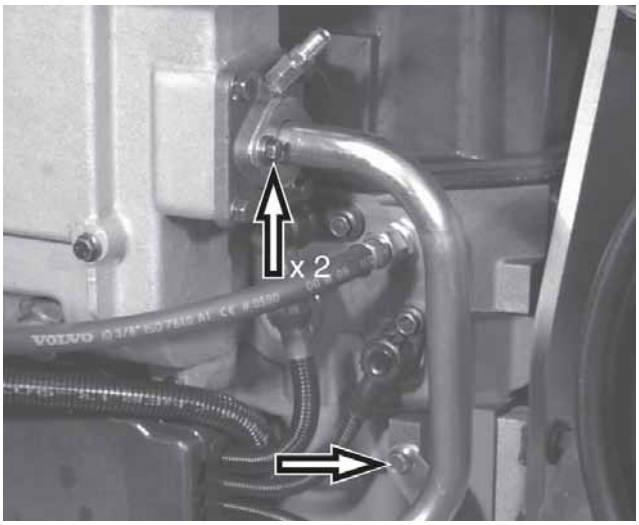
Step 2. Torque the bolts to 20 ± 2 Nm (15 ± 2 ft-lbf) in the order shown in the diagram.

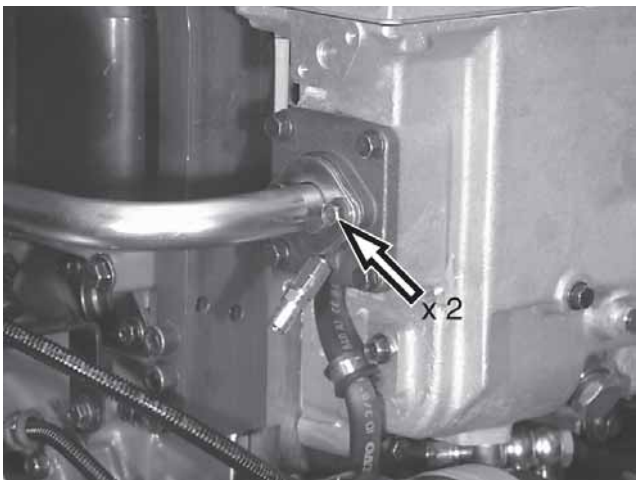
10



Reinstall the water pipe connectors on the ends of the charge air cooler using new sealing rings.

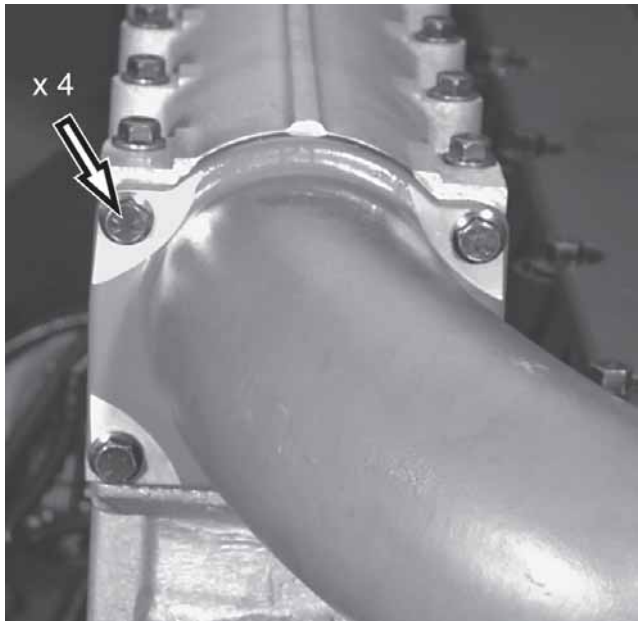
11





Reinstall the water pipes on the ends of the charge air cooler using new sealing rings.

12



Reinstall the turbo delivery pipe. Use new sealing rings.

13

Add coolant according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

14

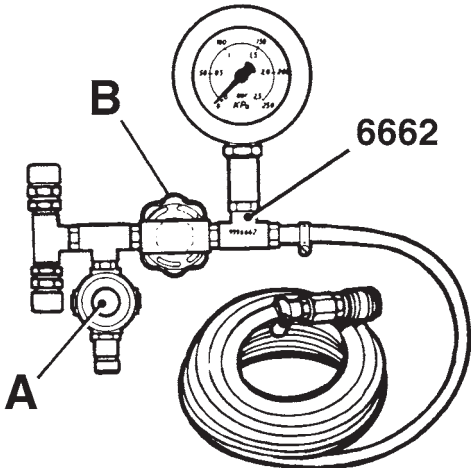
Start the engine and perform leakage and functional checks.

Charge air cooler, leakage test (TAD)

Special tools: 9996662, 885231, 885232

Checking test equipment

1

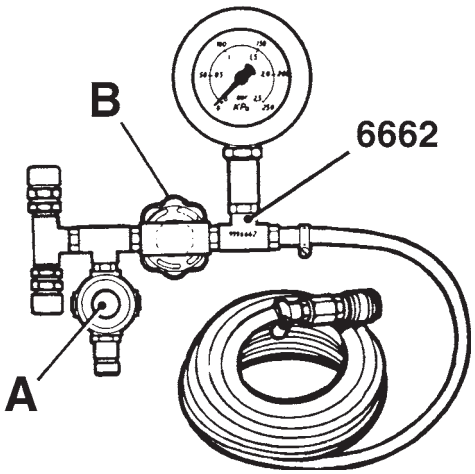


Check that the knob on the reducing valve (A) is turned all the way counter-clockwise and connect 9996662 to a compressed air source. Open valve (B) and adjust the reducing valve (A) until the pressure gauge shows a pressure of 100 kPa (14.5 psi).

NOTE: The knob on the reducing valve can be locked by pressing in on the knob.

NOTE: Always follow the applicable safety rules.

2



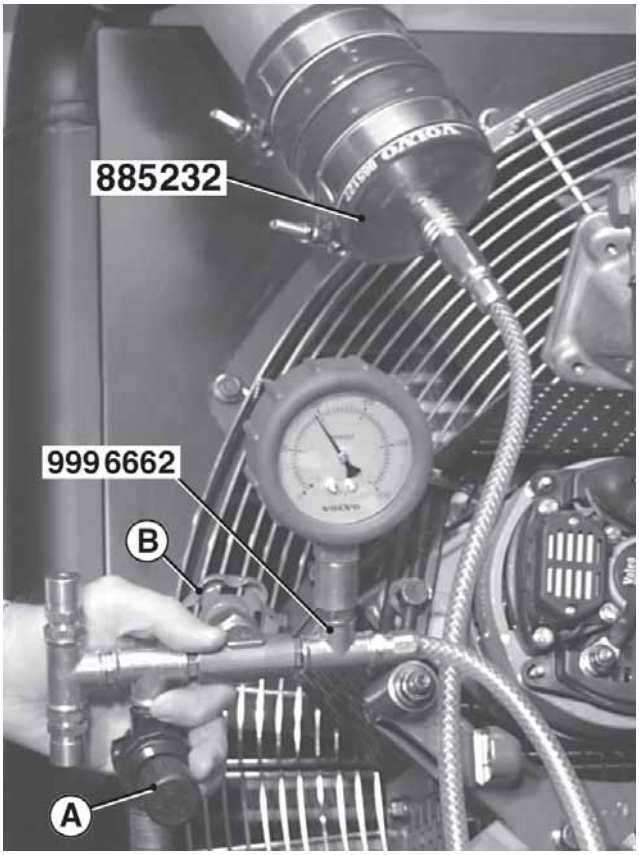
Close valve (B). If the pressure does not fall within two minutes, the equipment is considered reliable.

Leakage test

3

Remove the charge air pipe between the turbo compressor and the connector. Install pressure plug 995232 and tighten the clamp.

4



Remove the charge air pipe between the intake pipe and the connector. Install pressure plug 885231 on the connector and tighten the clamp.

Check that the valve on the reducing valve (A) is turned all the way counter-clockwise and connect 9996662 to the nipple on pressure plug 885231.

6

Connect 999662 to a compressed air source. Open valve (B) and adjust the reducing valve (A) until the pressure gauge shows a pressure of 100 kPa (14.5 psi). Close valve (B).

7

If the pressure does not fall within two minutes, the charge air cooler and the connections are tight.

NOTE: If the pressure falls, check that there is no leakage at the connections to the charge air pipe. Spray or brush water with a little detergent added around the connections to determine if they are leaking.

8

If the pressure falls and the connections are not leaking, the charge air cooler should be replaced with a new one. Repeat the leakage test to be sure that the charge air cooler is leaking.

9

After the leakage test is complete, shut of the compressed air supply, turn the knob on the reducing valve (A) fully counter-clockwise and release the compressed air.

10

Remove the leakage tester 9996662 and the pressure plug 885231. Reinstall the charge air pipe on the intake pipe using new gaskets and tighten the clamp.

11

Remove the pressure plug 885232. Reinstall the charge air pipe between the turbo compressor and the connection and tighten the clamp.

12

Start the engine and perform a leakage check.

Charge air cooler, cleaning

Part no.: 1141658-3

1 (TWD)

Drain the cooling system, see “Cooling system, draining.”

2

Remove the charge air cooler, see “Charge air cooler, changing.”

3

Clean the charge air element/cooler on the outside. Rinse the air passages with fresh water. Clean the inside with cleaner part no. 1141658-3 and blow dry with compressed air (or allow to stand and drain).

(TWD)

Alternatively, the entire cooling system can be filled with 15-20% concentrated coolant and drained after 1-2 days of operation. Then remove the charge air element and clean the air passages separately as required.

4

Rinse out the charge air cooler with neutralizer part no. 1141658-3 and blow dry with compressed air (or allow to stand and drain).

5

Reinstall the charge air element/cooler.

6 (TWD)

Fill with coolant as specified. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

7

Start engine and perform functional and leakage checks.

Radiator core, changing

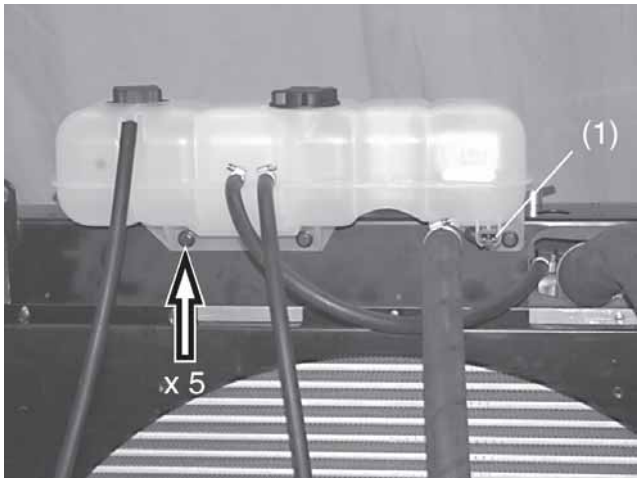
1

Open the main switch(es) and check that there is no power to the engine.

2

Drain the cooling system, see “Cooling system, draining”.

3

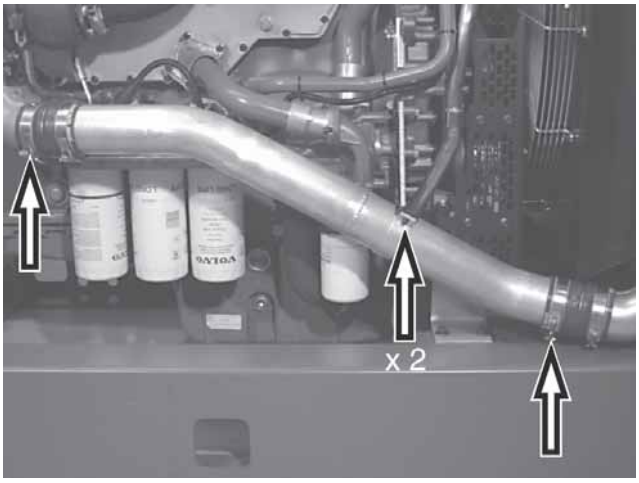


Disconnect the coolant level sensor from the outlet (1) and remove the expansion tank. Place the expansion tank on the engine.

4

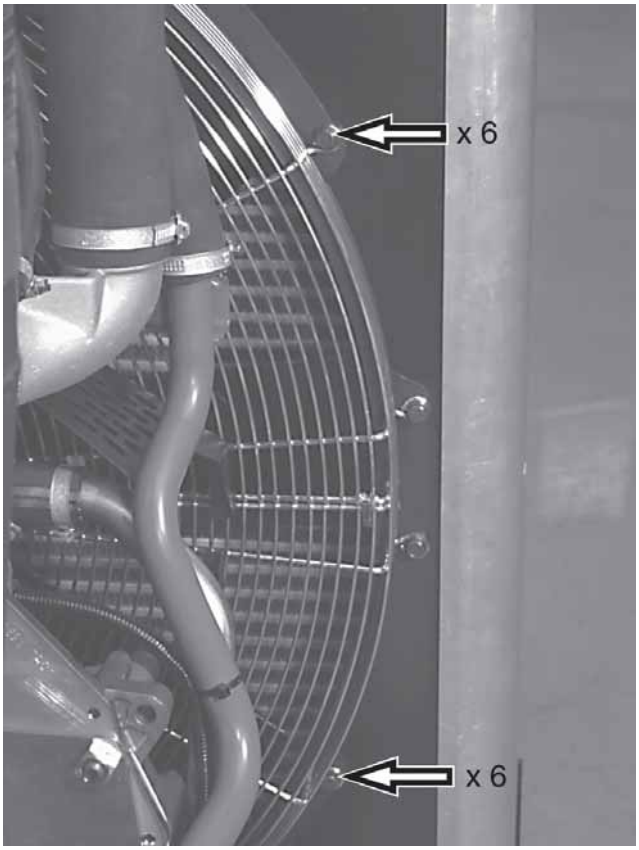
Remove the upper coolant hose and the hose to the expansion tank from the radiator.

5 (TAD)



Remove the lower turbo delivery pipe from the charge air cooler.

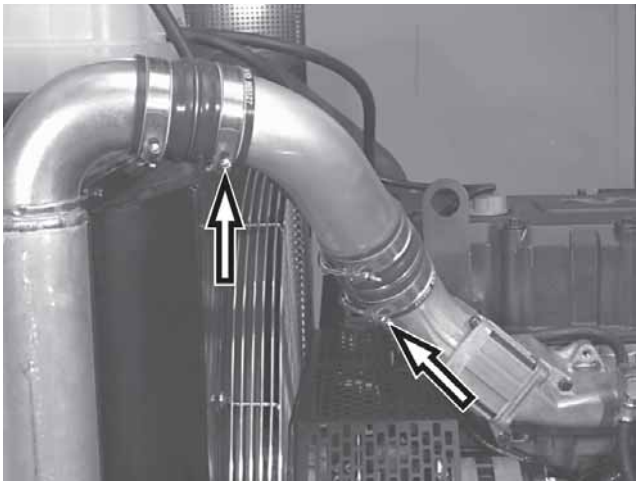
6



Remove the protective grille around the fan.

NOTE: The protective grille is mounted with the outer fan shroud.

7 (TAD)



Remove the upper turbo delivery pipe from the charge air cooler.

8

Remove the lower coolant hose from the radiator.

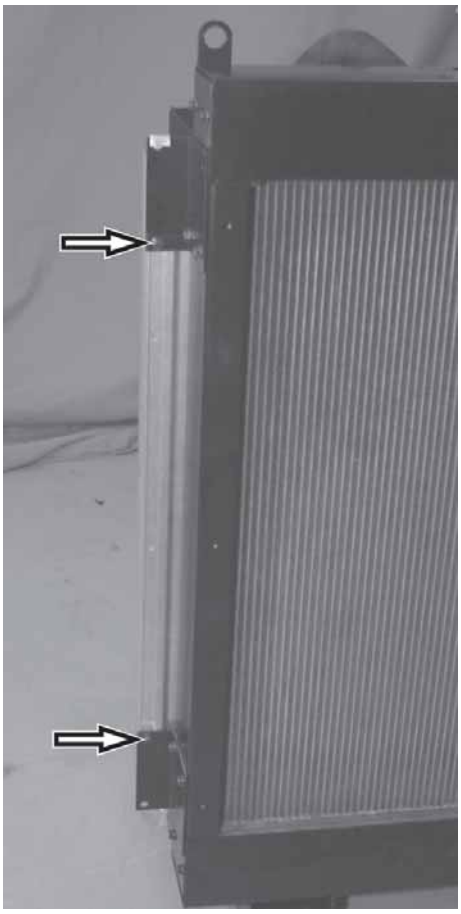
9

Remove the radiator assembly from the engine support.

10

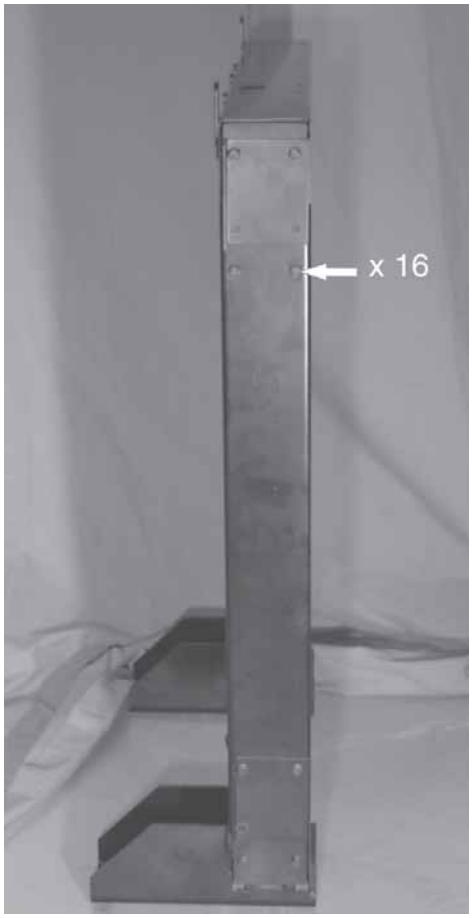
Carefully lift the radiator assembly forward ensuring that it does not catch. Then lift the radiator assembly out to a place where the radiator core can be changed.

11 (TAD)



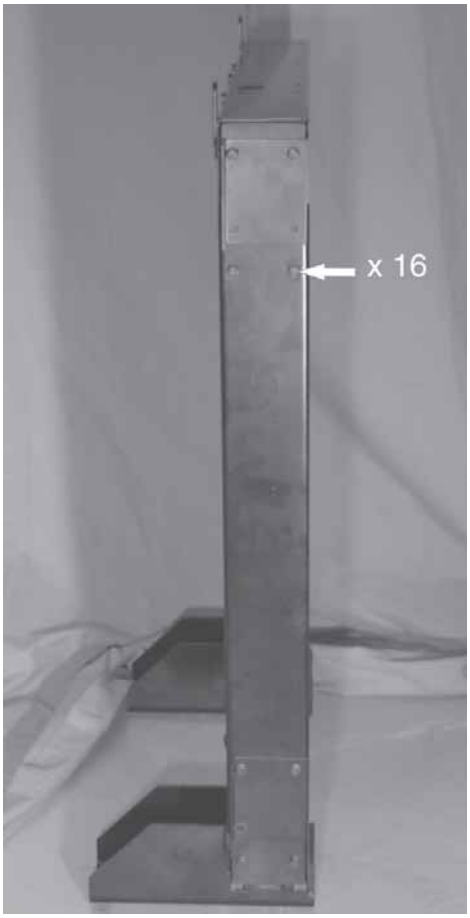
Loosen the charge air cooler at the left and right sides of the radiator.

12



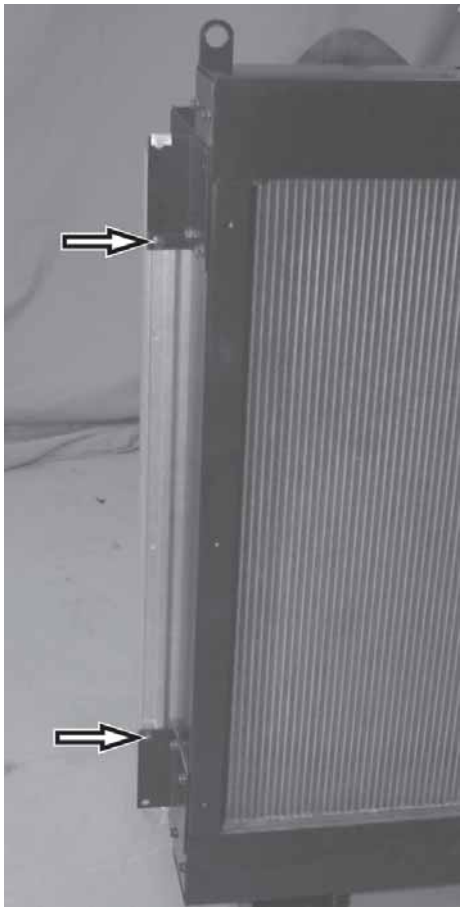
Remove the frames and lift away the cover. Remove the radiator core.

13



Install the new radiator core, reinstall the frames and cover, tighten the bolts (16x).

14 (TAD)



Reinstall the charge air cooler and tighten on the left and right sides.

15

Carefully lift the radiator assembly onto the engine support.

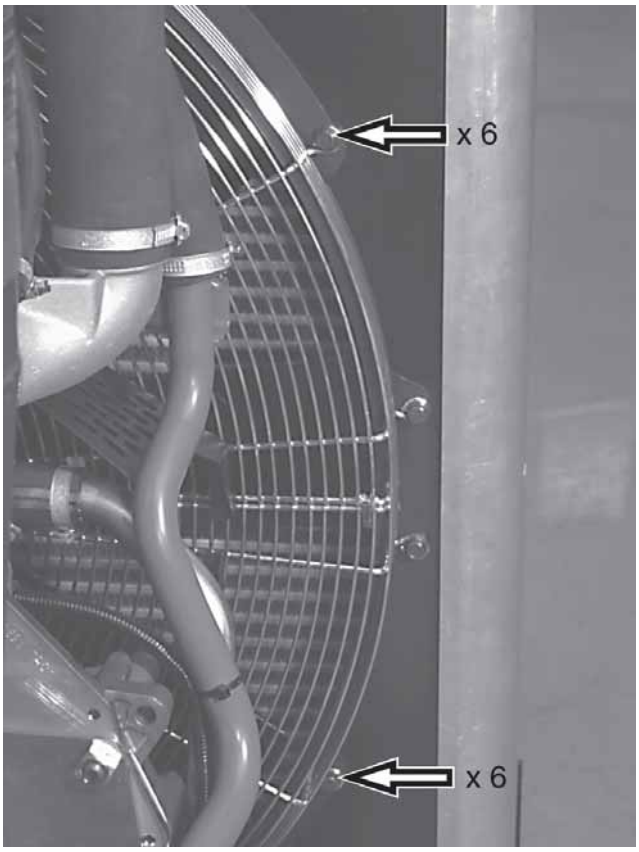
NOTE: Do not forget the outer fan shroud.

NOTE: Fit the lower radiator hose and turbo delivery pipe in before attaching the radiator to the engine support.

16

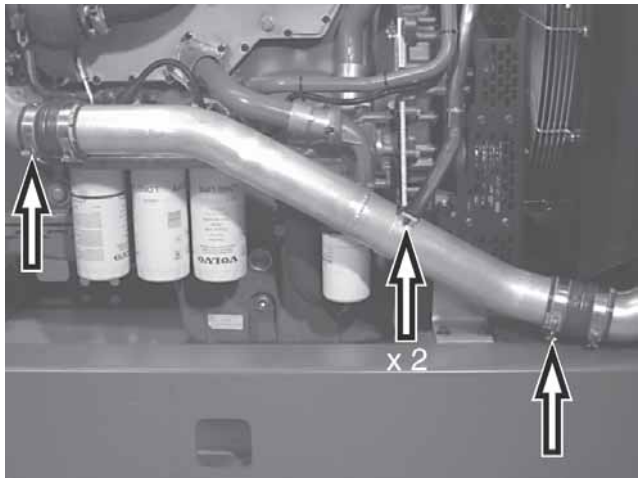
Tighten the lower radiator hose clamp.

17



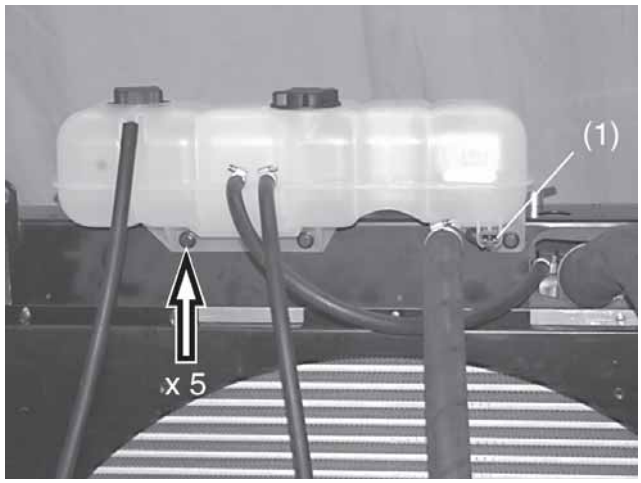
Reinstall the protective grille and outer fan shroud.

18 (TAD)



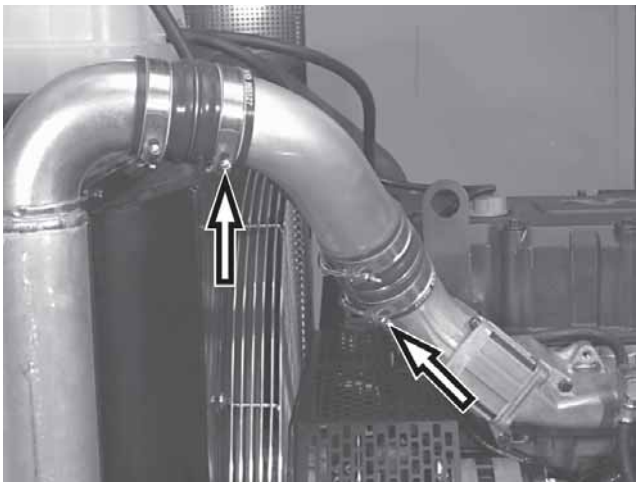
Clamp the lower turbo delivery pipe to the charge air cooler.

19



Reinstall the expansion tank on the radiator, connect the coolant level sensor (1) and clamp the hose to the expansion tank.

20 (TAD)



Clamp the upper turbo delivery pipe to the charge air cooler.

21

Add coolant according to specifications. See “Technical data TAD1240GE, TAD1241GE/VE, TAD1242GE/VE, TWD1240VE”.

NOTE: Mix the correct volume in advance to be sure that the system is filled.

22

Start the engine and check for leaks.

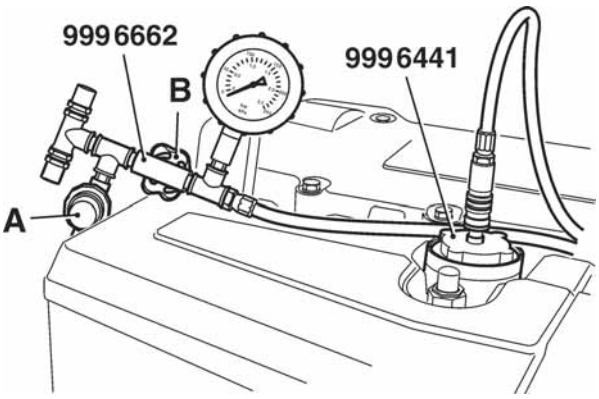
Cooling system, leakage testing

Special tools: 9996441, 9996662

Checking test equipment

1

Check that the knob on the reducing valve (A) is turned all the way counter-clockwise and connect 9996662 to a compressed air source.

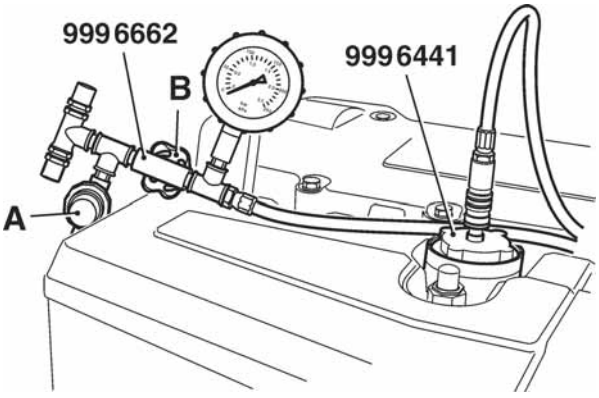


Open valve (B) and adjust the reducing valve (A) until the pressure gauge shows a pressure of 100 kPa (14.5 psi).

NOTE: The knob on the reducing valve (A) can be locked by pressing in on the knob.

NOTE: Always follow the applicable safety rules.

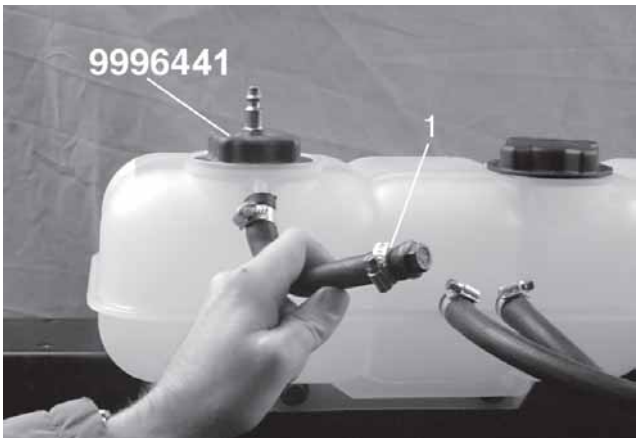
2



Close valve (B). If the pressure does not fall within two minutes, the equipment is considered reliable.

Leakage test

3

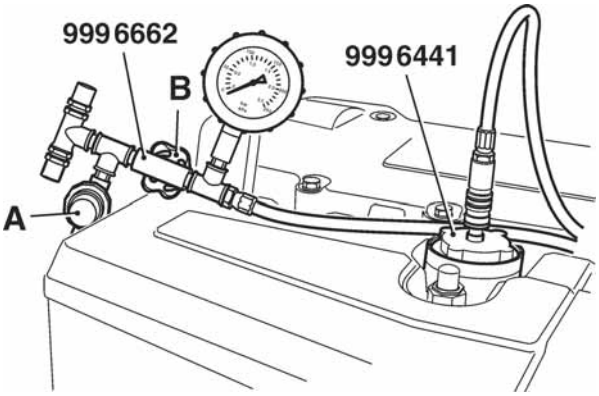


Screw off the filler cap on the expansion tank and screw on cap 9996441. Check that the drain opening (1) on the expansion tank is plugged.

4

Check all hoses and clamps for damage.

5

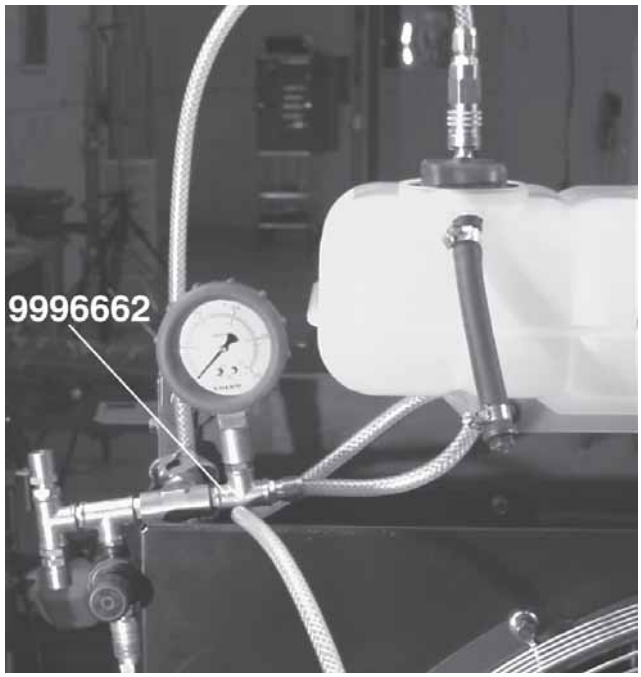


Connect the leak tester 9996662 to a source of compressed air and check that the knob on the reducing valve (A) is turned fully counter-clockwise.

6

Connect leak tester 9996662 to the air nipple on cap 9996433.

7



Turn the knob on the reducing valve (A) clockwise until the pressure gauge shows a pressure of 50 kPa (7 psi). Close valve (B). The pressure should not show any decrease for two minutes if the system has no leaks.

NOTE: If there is any doubt that the cooling system is not leaking, repeat the leak test until the test gives a clear result.

8

Remove the leak tester and open the drain on the expansion tank.

9

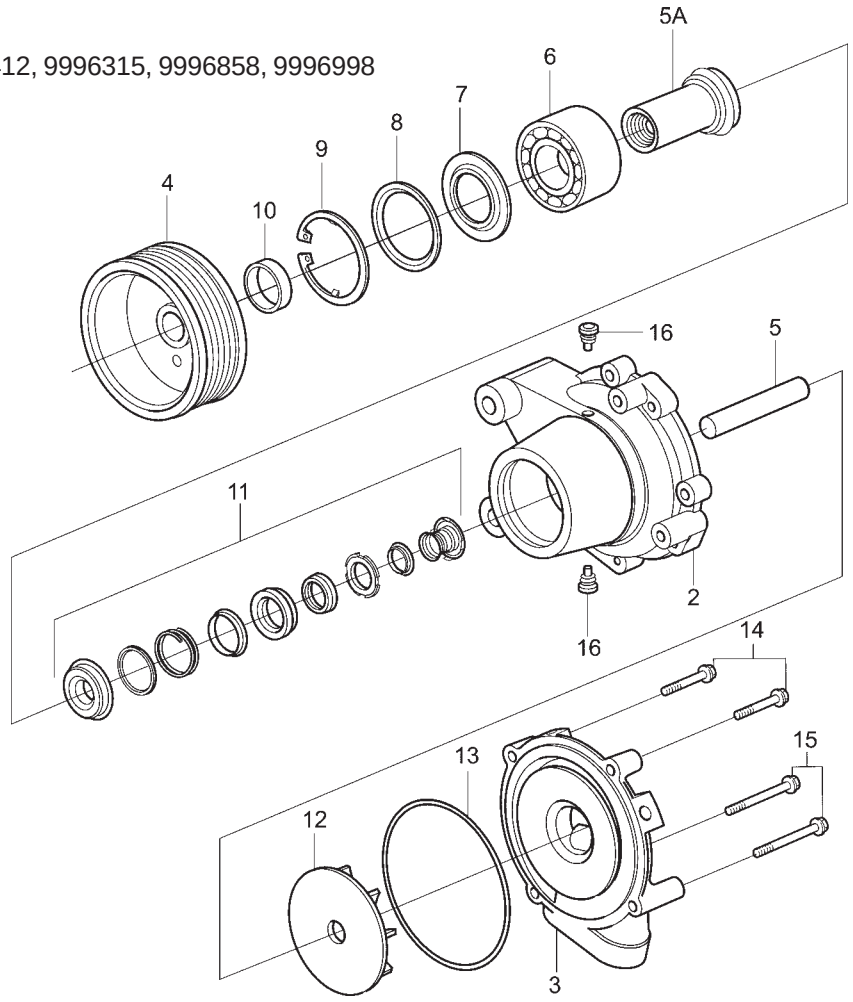
Check the coolant level in the expansion tank.

10

Start the engine and perform a leak check.

Extra coolant pump, overhaul (TWD)

Special tools: 9992412, 9996315, 9996858, 9996998



Note! All numbers in parenthesis refers to the picture above.

1

Note! Mark the fitting position of the gable (3) on the coolant pump housing (2) before removing.

Remove the gable (3) and the O-ring (13).

2

Press out the shovel wheel (12) together with the axle (5), use gauge pin 9996858.

3

Remove the pulley (4), use a suitable puller. Remove the spacer washer (10).

4

Remove the clamp washer (9), spacer washer (8) and the guard ring (7).

5

Remove the sealing washer (11).

6

Press out the bearing (6) together with the bearing axis (5A), use gauge pin 9996858.

7

Remove the plugs (16), check that the draining holes are clean and not blocked (should be Ø 7 mm).

8

Clean all the coolant pumps parts well and check for damages and wear.

9

Apply bearing grease on the bearing axis (5A) and press on the new bearing (6), use gauge pin 9992412.

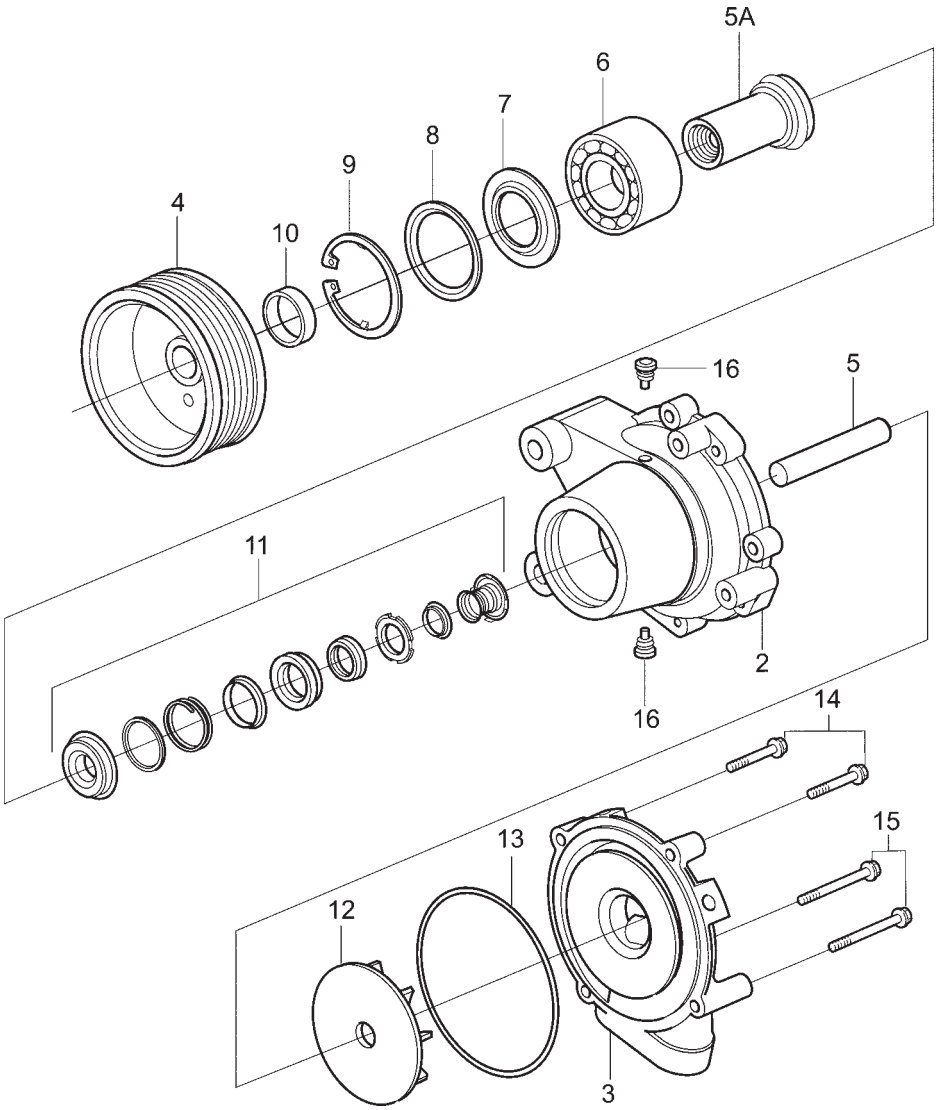
10

Apply bearing grease in the bearing housing. Press the new bearing (6) and the bearing axis (5A) in the bearing housing, use gauge pin 9992412.

11

Mount the guard washer (7), the spacer washer (8) and the clamp ring (9).

Note! The phase edge of the spacer washer and the heads of the clamp ring must be mounted facing the bearing.



12

Mount the spacer washer (10) on the bearing axis (5A).

13

Press the pulley (4) on the axle (5), use gauge pin 9992412. Place a pipe with a inner diameter of 27 mm and a outer diameter of 34 mm to support the bearing axis (5A) from behind.

14

Note! The sealing ring (11) is delivered as one unit and not as the picture shows.

Press the new sealing ring (11) in to the coolant pump housing (2), use gauge pin 9996998.

15

Put a piece of metall that is wider then the coolant pump housing (2) between the axle (5) and the mount ing tool. When pressing in the axle (5) in the bearing axis (5A) it will be mounted in line with the edges of the coolant pump housing (2).

Apply bearing grease on the axle (5) and press it in the bearing axis (5A).

16

Mount gauge pin 9996315 in the bearing axis (5A) then tighten the nut with your hands.
Put a washer on the shovel wheel (12) so that the axle (5) will come out 2 mm from the shovel wheel.
The washer must be 2 mm thick and have a inner diameter that is wider then the axle (5).
Press the shovel wheel (12) on the axle (5).

Note! Let coolant pump rest on the nut on the gauge pin 9996315 during the entire mounting operation.

17

Mount the gable (3) with a new O-ring (13).

Notes

Report form

Do you have any complaints or other comments about this manual? Please make a copy of this page, write your comments down and post it to us. The address is at the bottom of the page. We would prefer you to write in English or Swedish.

From: .....

.....

.....

.....

Refers to publication: .....

Publication no.: ..... Issued: .....

Suggestion/reasons: .....

.....

.....

.....

.....

.....

.....

.....

.....

Date: .....

Name: .....

AB Volvo Penta
Customer Support
Dept. 42200
SE-405 08 Gothenburg
Sweden

7741302-9 English 03-2009